Welding Engineer

EER BUSINESS AND TECHNICAL JOURNAL OF THE WELDING INDUSTRY

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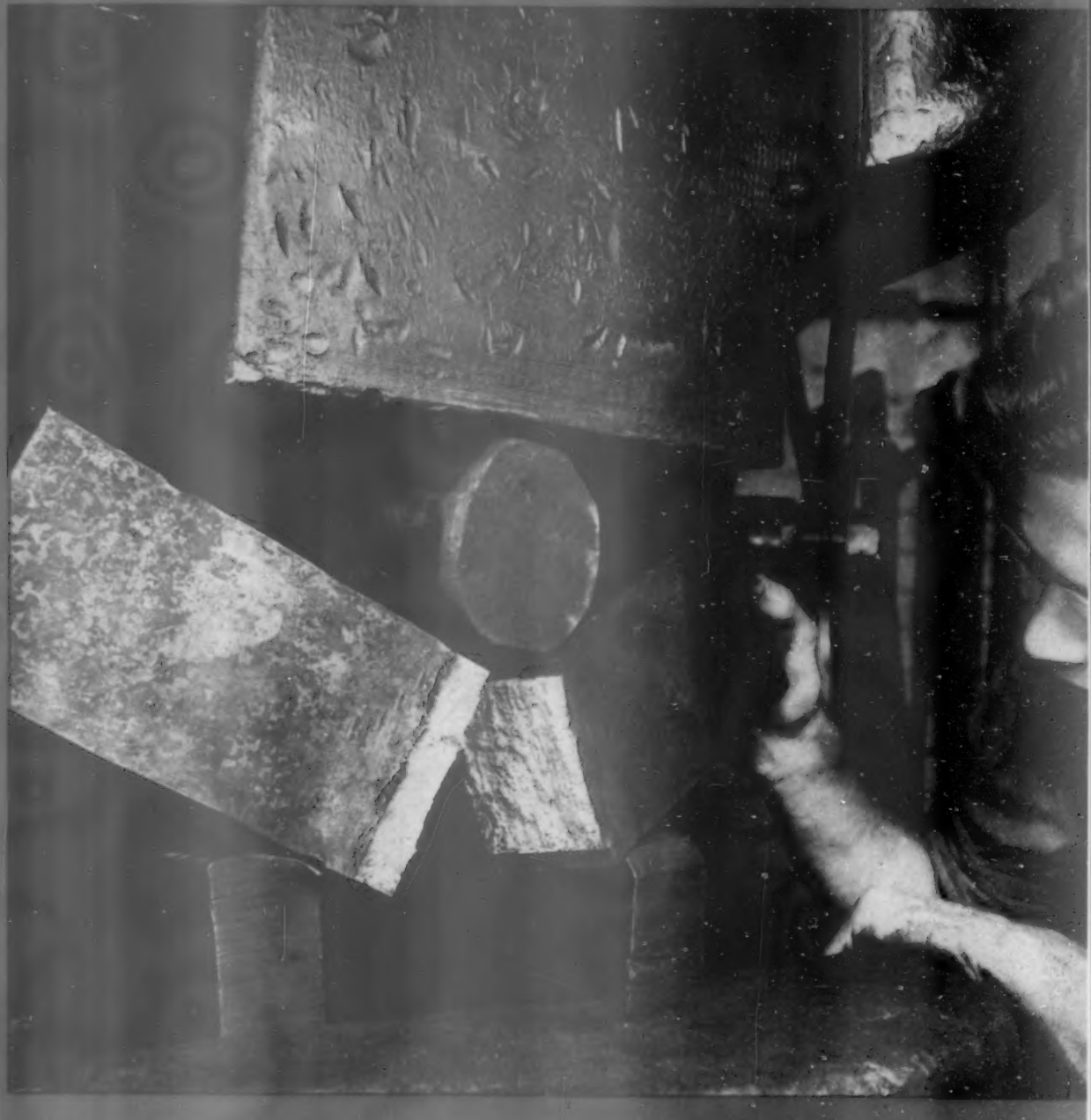

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WESTINGHOUSE ELECTRIC

★ PRODUCTION

Fig. 1—182-ton Paulista Electric Passenger Locomotive

All-Welded Electric Streamliner

★ On four locomotives recently constructed for South American service complicated castings were replaced with steel plates and shapes. Modern welding and cutting methods have made this possible and at the same time resulted in more pleasing design.

by
W. D. BEARCE
Transportation Dept.
General Electric Co.
Erie Works

THE EXTENSIVE substitution of fabricated structures for castings in recent years is a result of a continuous search for methods of cost and weight reduction without sacrificing quality or utility. An unusual example of the versatility of modern welding technique is presented in the construction of four modern high-speed streamlined electric passenger locomotives, which were recently placed in operation by the Paulista Railway in Brazil. (Fig. 1)

In 1921 the Paulista Railway began to electrify its system, and since then has successfully extended its electrically operated lines until now 178 route-miles partially double track are being operated. Since the initial motive equipment was purchased, the top speed of passenger locomotives has been gradually increased from 53 mph so that the new 90 mph locomotives are but an indication of continued improvement in motive power by this progressive operating company. All of its 49 electric freight, passenger and switching locomotives, with the exception of two units, were built in the United States.

The design of these new locomotives is in keeping with other modern railroad service, such as is furnished by adequate sleeping, chair and dining car service, high speed schedules and air conditioning. The longer, heavier trains and higher speed require heavier, higher-capacity motive power which is being supplied by these locomotives. Their smooth streamlined design, in addition to facilitating high speed running, has a definite appeal to the riding public because of their artistic and attractive appearance. Such a design has only been made possible by the rapid advances in the technique of welding during recent years.

In several respects this locomotive design is outstanding:

(a) It is the largest locomotive to be fabricated entirely by welding — cab, platform and trucks.

(b) It is the first streamlined electric locomotive to be built in this country for export.

(c) The main platform is one of the most massive structures yet to be fabricated entirely by welding.

(d) The main truck frames are the largest locomotive truck assemblies up to this time to be built by welding.

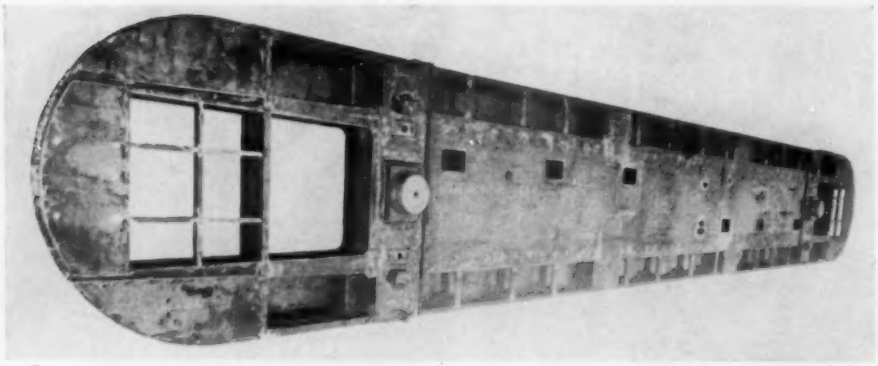

Fig. 2—View of the underside of the completed cab underframe showing center pins for the main supports, openings in the underside of the structure for ventilating the 6 traction motors and the lifting lugs on each side of the center pins.

The service requirements for a railroad locomotive demand an exceptionally rigid structure to withstand pulling and buffing stresses, unavoidable vibrations at high speed and freedom from expensive maintenance. To meet these requirements heavy locomotive parts have been until recently for the most part steel castings.

Since the success of a welding operation depends so largely on the ability of the weldor, it is the practice of the manufacturing department to require the weldors to pass a qualification test in order to be sure that they have the necessary technique to produce satisfactory welds.

Streamline Construction

A feature of this locomotive is its streamlined construction not only for lowering wind resistance at high speeds but also to give attractive appearance in keeping with the modern trend in motive power design. Electric welding of the rounded nose and other cab sheeting lends itself admirably to the streamlined cab construction.

The new Paulista locomotives weigh complete 182 tons each, operate from a 3000-volt d-c trolley, with a maximum operating speed of 90 miles per hour. The six motors provide a nominal hourly rating of 4470 horsepower, but approximately double this rating can be used for short periods.

Electric power is supplied from a 3000-volt d-c catenary trolley and is used at this voltage by the traction motors. Two 3000/65 volt motor-generator sets are used for actuating the controls, exhausters and operating the various other low-voltage auxiliaries and lights, as well as the blowers for ventilating the motors. Because of the long steep grades all of the road locomotives on the Paulista use regenerative electric braking. For this one of the motor-generator sets is used to supply separate excitation to the fields of the motors to facilitate their stable operation as generators during the down-hill operation. The energy recovered from the braking operation is transmitted over the trolley wires to the substations and thence to the 60-cycle transmission system.

Platform

The cab underframe or, in the language of locomotive builders, the "platform" is one of the most massive, single structures yet assembled by welding fabrication. The backbone of this structure, which is 72 feet long, consists of two 142 lb., 21½ in. by 13⅛ in. H-beams running the full length of the structure, forming the main center sills. These beams are located about five feet apart and are reinforced with top and bottom plates ½ in. thick forming the floor of the cab as well as a central duct which is used for distributing air from the blowers in the cab to the traction motors. Side sills of 10 in. standard steel channels are welded to each side of the main structure bringing the total width to a little over 10 ft. Bolsters, supporting center plates, side bearings and lifting lugs are built of heavy H-beams and plates. Fig. 2)

An unusual feature of this construction is the fabrication of portions of the main H-beams extending beyond the supporting center plates to reduce the weight where less rigidity is required. This is effected by cutting away the flange on both sides of the web to give a tapered form without changing the height of the web, and by flame-cutting several openings in the web.

Machining Eliminated

The procedure in the final assembly of the platform consists in the accurate placing of the various subassemblies and the main H-beams in fixtures on a rigid iron floor and then tack-welding the parts together preparatory to the final complete welding. After all the parts were securely positioned all joints were completely welded. One of the important advantages obtained was the elimination to a large extent of machining operations on the completely assembled platform. The total weight of this platform structure when ready for assembling the cab is somewhat in excess of 50,000 lbs.

Numerous tests indicate that this completed structure is the equal if not superior to a similar casting in every respect, furthermore a greater uniformity of material is secured and less weight for equivalent rigidity. In the design of the locomotive the platform structure was proportioned to support the entire cab and contents. The maximum deflection of this structure between centerplates (46 ft. 6 in.) was less than one quarter of an inch.

An unpremeditated test soon after the locomotives went into service occurred when a train just

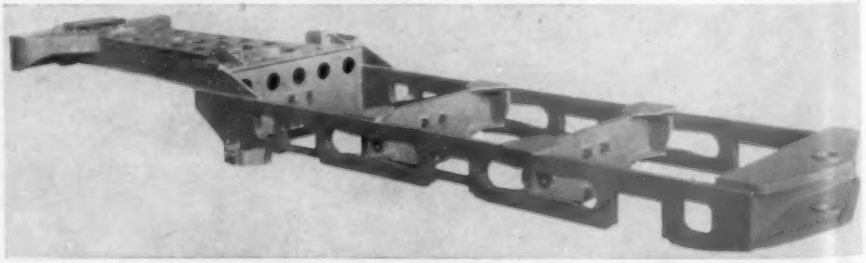

Fig. 3—Welded driving-truck frame for Paulista Railway's electric locomotive.

leaving a station accidentally ran through an open switch at about 20 m.p.h. The 182 ton locomotive plowed through ties and roadbed for some distance before coming to a stop and was immediately taken to the shop for inspection. Since no distortion of the running gear could be detected it was promptly returned to service.

A by-product of the fabricated method of construction is the utilization of added manufacturing flexibility made possible by the machining of the several subassemblies individually before welding them into the final complete structure. This is in contrast to the necessity for unusually large size and special tools for machining a casting of this size. The accuracy with which these parts can be assembled, however, permits practically all of the machining to be completed before the final assembly.

Welded Truck Frames

In contrast to the massive construction of the platform above described the large driving truck frames and the lighter guiding truck frames present a problem requiring unusual skill on the part of the operators in the handling of welding tools to secure the complete fabrication of such a large and complicated unit.

The side frames for the guiding trucks were fabricated, by flame-cutting, from 1½ in. steel plate, and the main trucks from 4-inch steel plate. On the guiding truck the side member was reinforced by welding along the top surface an overhanging 1 in. by 3 in. steel strip, which forms an integral part of the side frame.

Fig. 4—Welding the driving-truck frame. Note that the journal pedestals are set up in a fixture.

The side frames for the main trucks were machined on the top and end surfaces for the reception of end plates after which they were placed in a fixture to align the pedestal block openings and the welded bolsters. So placed the side frames are then preheated and fillet welds made in the vertical position. The cross tie with its lugs for supporting the motor nose is built up as a separate unit and welded to the truck side frames in the fixture. The end frames are assembled and welded as a separate subassembly and then attached, by welding in a fixture, to the main side frame.

A special technique has been developed by the weldors in the final assembly of the several subassemblies to insure high accuracy in the completed structure and to avoid the possibility of warping during the operation. The best results were obtained by tack-welding the parts at various points and then welding in the remaining spaces alternately one side and the other.

The centerplates on the main truck were located and welded in place after the truck frame is completely assembled while the last operation was the welding in place of the pedestal block. The truck frame is now placed in the fixture attached rigidly to the floor plates and the blocks are assembled and slipped in place. They were shimmed before welding to prevent excesive movement during the operation. It is notable that these pedestal blocks assembled by this method are required to be located accurately within ten to fifteen thousandths of an inch, and no machining was required to secure this result.

The side frames of the main trucks are constructed from mill rolled normalized open hearth steel 4 in. thick having an ultimate tensile strength of 55,000 to 65,000 p.s.i. The maximum carbon content is .25 percent. These plates are flame-cut to quite accurate dimensions requiring little or no machining. All other fabricated parts use the ordinary commercial carbon steel which has entirely adequate physical properties for the parts involved.

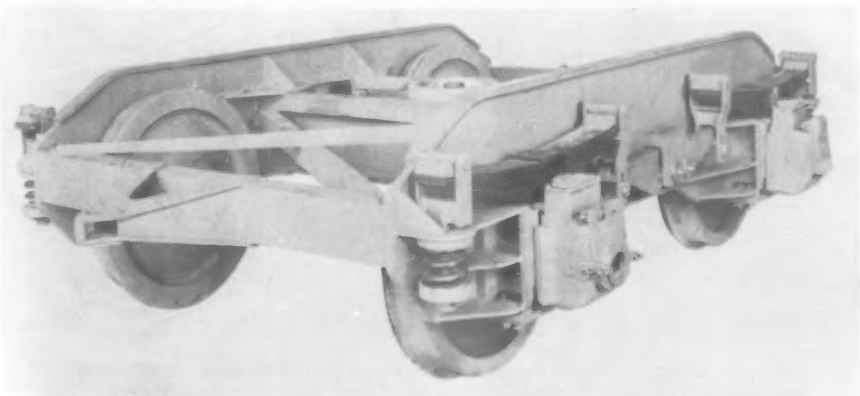

Fig. 5—Guiding truck complete with wheels and axles.

Cab Structure

The application of welding to the construction of the cab and roof of the locomotive gives an opportunity for further economies in manufacture at the same time providing ample strength and rigidity together with a smooth exterior in keeping with the streamlined construction of these locomotives. A new welding technique permits the subassemblies of portions of the sides and roof to be welded together in a fixture on the shop floor, or in the case of the rounded ends formed

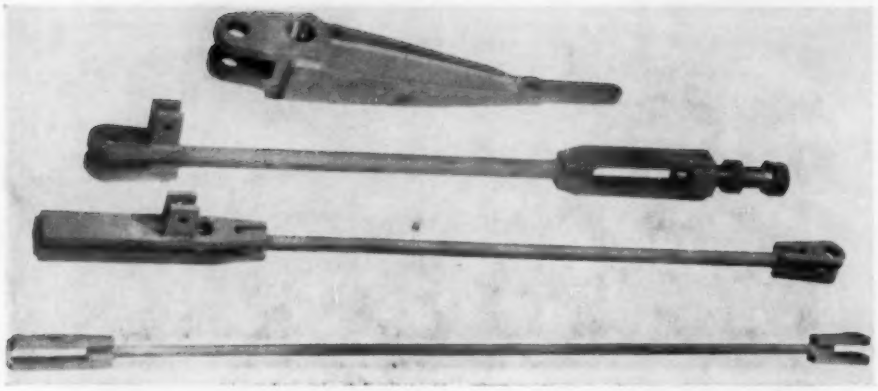

Fig. 6—Main brake lever, turnbuckle and rods, fabricated by arc welding. An excellent example of small parts made by welding instead of using forgings.

over cast iron blocks and the seams completely welded. In the final assembly the various subassemblies are erected on the cab platform and welded permanently in place. To secure the uniformly streamlined cab structure required for this design, all of the seams were ground smooth on the outside and the louvers, windows, belt rail and roof hatch covers were given a smooth fit.

The complete cab and platform structure including equipment has a total weight of about 72 tons. To facilitate handling for railroad and water shipment, the pantographs and some other easily removable accessories were removed so that the shipping weight of the cab structure with skids was a little under 70 tons.

Apparatus Compartments

To further facilitate the use of welding an apparatus compartment was built by welding on the shop floor and various pieces of apparatus and control equipment together with the wiring were placed in position in this welded frame. The completely assembled unit could then be dropped into position in the locomotive and securely welded in place to become an integral part of the locomotive cab.

Miscellaneous Welded Parts

Adaptation of flame-cutting as well as welding to the fabrication of brake parts, spring hangers and other small accessory parts of the locomotive simplified the manufacturing problem over former practices. (Fig. 6)

The welding electrodes used in the construction of this locomotive were of several types having the minimum physical values as follows:

Tensile strength	60,000 lb/sq in.
Yield	45,000 lb/sq in.
Endurance limit	28,000 lb/sq in.
Elongation	30%

For vertical and overhead welds coated electrodes using direct current were employed. For horizontal and flat welds an alternating current electrode was used.

All-Welded Lifting Device

The export shipment of the Paulista locomotive presented a particularly difficult problem in handling since the cab package alone weighed almost 70 tons. The unloading of these cabs at Santos, Brazil, was effected by the use of a special lifting device designed to handle the package safely without adding materially to its weight. (Fig. 7)

This device was also an example of the use of modern technique in electric welding. A rigid beam fitted with a lifting bail at the center and slings at each end was arranged to lift through hatches in the cab roof to simplify balancing on the floating crane.

The beam itself is a 230 lb. 35⅞ in. by 16½ in. H-beam. Its overall length is 28 feet 6 inches. To secure the required stiffness the flanges were reinforced by a series of ribs held in place by welding to the web and flanges.

The possibility of any distortion in the structure due to the welding operation was eliminated by staggering the welds from one side of the web to the other. The lifting bail and the sling pin seats are also fastened to the beam by welding. The complete lifting rigging with slings weighs only 9500 pounds which is well within the capacity of the floating crane at Santos.

Conclusion

To sum up, the advances in design and manufacturing technique include:

1. **Its application to the largest electric locomotive to be fabricated entirely by welding, i.e., trucks, platform and cab.**
2. **Modern methods simplified the problem of streamlining for speed and apparatus.**
3. **A distinct saving in weight and material was secured without loss of strength or rigidity.**
4. **Methods used assisted in cost reduction without sacrificing quality or utility.**

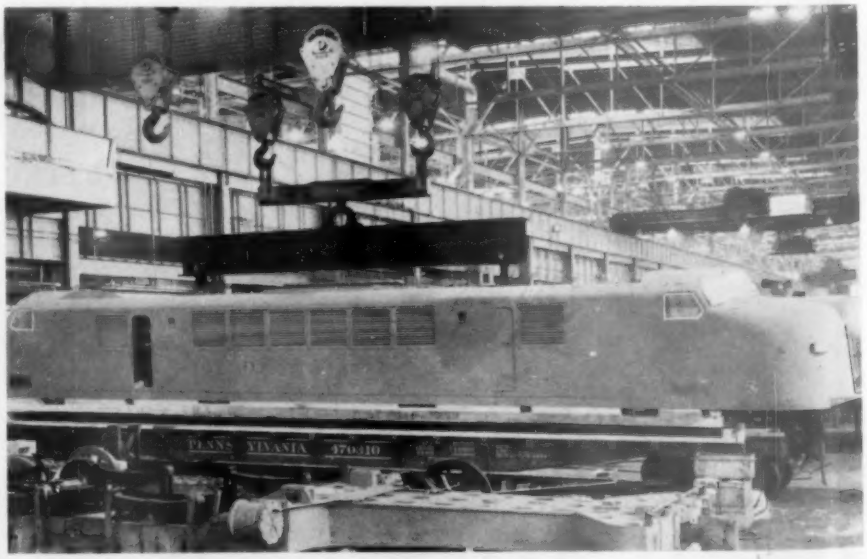

Fig. 7—Special lifting device for handling the cab of the Paulista passenger locomotive from ship to dock in Brazil. This device facilities the easy handling of the cab structure without danger of distorting the cab plates or frame. Complete lifting device weighs only 9500 lb. and actually supports the 72-ton package.

★ PRODUCTION

MEASURING WELD-TIME CYCLES

by
R. S. FULTON
President
National Time and Signal Corp.
Detroit, Mich.

★ Part 2—The ability of the engineer to accurately time spot welds has made the spot welder more useful as a production tool. The Interrupter Cam Control Type Timer can be set accurately with an ordinary pocket rule.

IN constructing the Interrupter Cam Control Assembly a simple means was provided to regulate this critical "off" period. Two identical cams, one which may be positioned with respect to the other are fitted together as one cam to constitute the assembly. As a movable cam is rotated, the length of the notched portion can be adjusted to micrometer dimensions without interfering with the "on" period or number of interruptions. The shutter, which controls the "on" period is mounted on the adjoining cam forming a part of the series connected weld control circuit.

The interrupted weld process has many other acceptable characteristics which it is believed may prove revolutionary in the not far distant future. About a year ago the Chevrolet Motor Company made some tests in the light metal field ordinary No. 20 and No. 22 gauge steel sheets, by running two identical line operations using a single spot timer in one case and the Interrupter timer in the other. These tests were conducted by E. P. Coskey of Chevrolet Standards Department with the following results*:

1. The character of the weld in both cases was fairly uniform, but the interrupter eleminated almost all splashing on the surface.

2. On our body surfaces, we were able to save a disc grinding operation.

3. On body sheets, when three interruptions on 3 cycles "on" and 1 cycle "off" were used; the transformer, a 34 KVA unit, was connected on the No. 1 or lowest tap. On the same operation with the single spot timer it was necessary to use No. 4 or No. 5 tap to produce the best results.

4. Careful inspection of electrodes in each case disclosed that with the Interrupter weld method electrode wear was cut in half, in one case electrode replacement was reduced to 20 percent of previous losses. This seemed increditable, as the number of individual current passages was tripled (three to every joint, against one) so a further record was kept for some time on various welding operations. The results were identical and proved that electrodes on thin sheets will last from two to three times as long when the welds are interrupted.

5. It was also discovered that the life of the contacts on the magnetic contactors was increased considerably, in spite of the fact that they functioned three times as often. The explanation for this, undoubtedly, is that with the interrupted weld it is possible to reduce the transformer heat to a minimum.

6. Another conclusion, apart from the actual weld data, was the reduction in the demand or peak requirements of purchased electrical energy. There was an actual, noticeable saving at one plant that had been fully equipped with Interrupter Timers.

Due to these experiments and the data obtained a great many Chevrolet Welding Operations have been changed over to the Interrupter timed method. Certainly it presents a new and different method of welding light metal, which is giving excellent results in several of their widely scattered assembly plants.

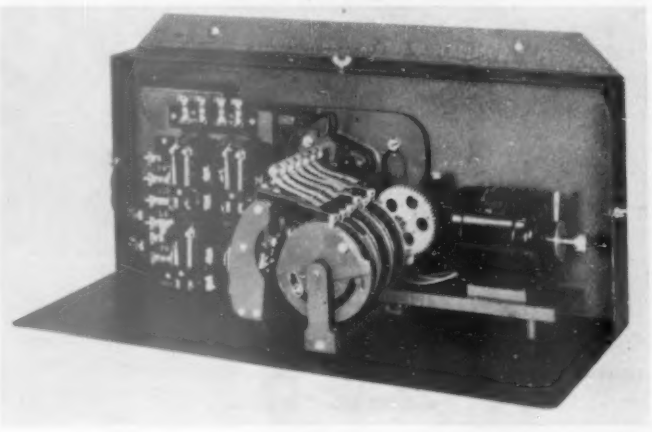

Figure 5—A synchronous Timer for stainless steel and non-ferrous metals. It controls pressure to electrode in timed sequence before weld and hold - time after weld.

*These findings of Chevrolet are Mr. Coskey's verbal statements.

How much easier is this simple method than are the others, especially in those cases where there is not the slightest idea as to weld-time actually obtained! Some large plants have instruments for use in reading weld-time but most factories are without a cycle counter. These places, unable to interpret cycle variables, or know whether they exist, are lost when trouble develops.

Setting the Timer

The motor driven cam operated timer, however, relieves this uncertainty. Its inherent characteristics preclude variables. Every function is measured just as one measures a bar of metal, with a common ruler.

A short explanation tells why: First, the timer is driven by a constant speed motor, synchronous or otherwise. A gear train follows and this directly connects with the main weld control cam assembly thus, these cams rotate at a definite speed per minute. They do not necessarily run all the time but when started and stopped sufficient latitude is provided for the motor to get up to full speed before the weld-time period comes into play.

Assume that the gear train employed causes the cam to rotate 150 r.p.m. when in operation. The cams are accurately machined to a definite diameter so as to have a circumference of 12 in. (On this type timer the actual circumference is 11.5 in. At 150 r.p.m., the total peripherical travel is 150 x 12 in. or 1800 in. The travel then is ½ in. per cycle (based on 60 cycle current, there being 3600 cycles per minute). Now, if a weld-period of 3 cycles is desired it may be obtained by measuring off 1½ in. on the outer surface or periphery of the cam. The drop-off step on the second cam is located at this point with its contact point in series with the contact point controlled by the "drop-to-make" cam, 1½ in. behind this 'make" cam. Then with every revolution of the timer, the weld current will be terminated just 3 cycles after it is initiated. It must be borne in mind that the use of 2 cams instead of one is most important. It takes a very short interval of time for the contact to drop off the step, 5/32 of an inch, but it does take time.

Error Eliminated

That might be thought of as an item of error but the next cam does exactly the same thing: Hence, this slight delay is compensated for by an identical motion in the same direction by the "drop-to-break" rocker arm. There is no guesswork on this point. This action has been tested innumerable times on an oscillagraph and in all cases the two drop action effects balance each other perfectly. The timing of this weld control machine, is governed by just one variable, namely, the measured distance between the make and break steps which is set as desired, by referring to a printed chart for any desired rotating speed and using the common flexible scale to locate step distances. When the desired timing, as predetermined, is set up on the cams the weld-time as well as pressure time, if included, is fixed and will not vary. Every weld made, under this set-up, is accordingly uniform and regular.

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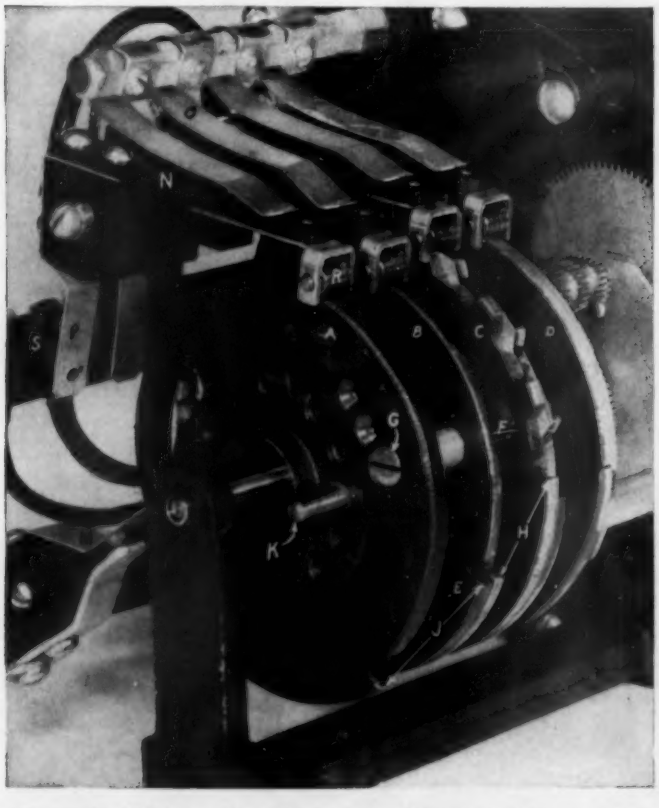


Figure 8—Close up of an Interrupter Cam Assembly. I equal squeeze time, and H is the the first long weld followed by shorter interruptions.

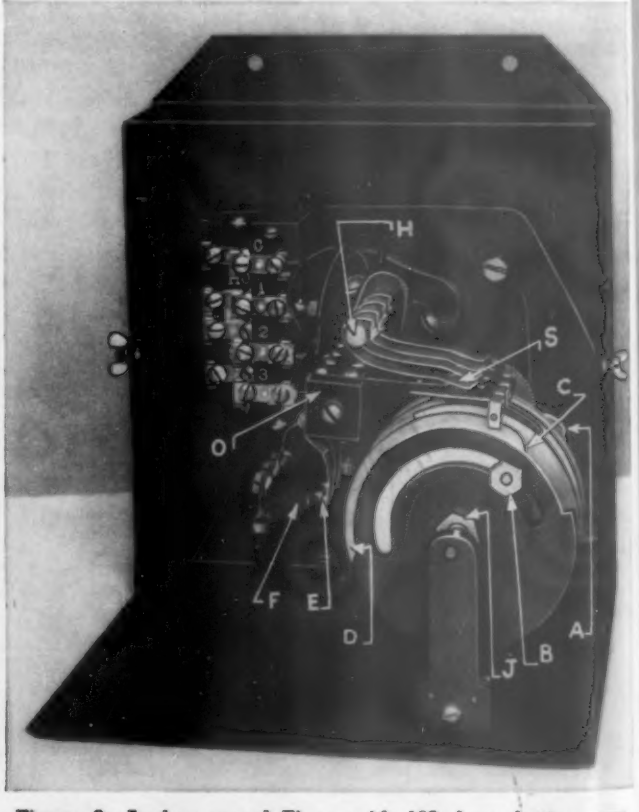


Figure 9—A slow speed Timer with 180 deg. shutter cams for heavy welding presses or for multi-function sequencing of controls prior to welding. Used extensively on spot welding automobile stress members.

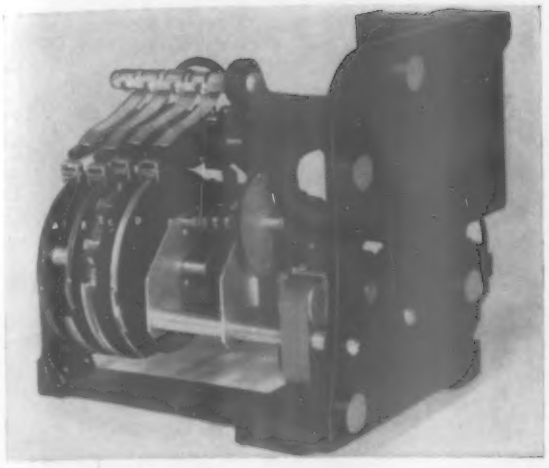


Figure 6—Rear view of an Interrupter Timer showing 5-speed quick change gear train. The large gear on the cam shaft can be slid to mesh with any of the 5 varying size pinions. Range 42 to 76 r.p.m.

There is little doubt but what the Interrupted process of welding will be more generally used in the future. With its application to different production problems a better knowledge of the proper ratios between the "off" and "on" periods will be metallurgically analyzed and proved.

Right now a new and very important problem is in the foreground. The huge National Defense Program is calling for production in large volume along many lines. One of the most active of these is in aircraft construction. Quantity manufacture with speed comparable almost to that of the automobile assembly line is being demanded. Naturally the important factor of safety in the finished product cannot be overlooked while gaining this production speed.

Aircraft Construction

The adoption of spot welding in lieu of the rivet, if made general, would greatly speed up production. A large Army bomber requires about 500,000 rivets or spot welds for its complete assembly. It is considered that spot welds cost less than 10% as much as a rivet. When measured in time value, with a proper set-up, the ratio of weld to rivet cost is close to 15 to 1 in favor of the weld, thus it is apparent that the answer to the Government's demand for speed would be the acceptance of the all-welded plane.

This is not too far from being an accomplished fact. Right now Army and Navy engineers have approved spot welded joints for stressed members. This is just the beginning of full recognition as there is much to be gained in addition to speed of fabrication. A spot welded wing section will be approximately 2½% lighter than the same wing, if riveted. Decreased weight is very important if strength and safety remain at least constant. Rivets, even if countersunk, will create on a wing surface a definite drag while spot welds do not. Rivets likewise, are subject to erosion and corrosion while spot welds, if properly made, are not.

Alloy Spot Welding

This brings us right back to the crux of the situation. There are non-ferrous metals and steel alloys, both of which are difficult to spot weld. It is done but either the method is laborious or the equipment cost excessive.

Experimentations to date have indicated that the solution lies in the proper control of the weld time, plus the amount of energy necessary to make a good weld. It has been found that the weld time is critical. It must be initiated at, or close to, the zero point on the sine curve, (see Fig. 7) and it must be cut off right at zero. The total weld time varies with metal thickness and structure, but in all cases it must be short and any variation in excess of ½ cycle is precarious.

Weld Time Consistency

Excellent results are being obtained with the motor driven cam operated timer, driven at a synchronous speed, in conjunction with a tube contactor. Weld time from ½ cycle up to 3 cycles has proved to be most desirable on stainless steel of varying thickness. However, in all cases, consistency in weld time is of paramount importance. With the synchronous motor driven cam timer, each revolution of the cam must be exactly synchronous in cycles. It might be 10 cycles or 11 cycles per revolution, but at a given number of points on the cam periphery the zero positions are fixed. The "on" weld contact controlling cam has its "drop-to-make" point set by predetermination so the weld circuit is closed just before zero; with the tube contactor in the circuit the welding transform primary circuit is closed instantaneously without any mechanical lag or hesitation. The weld then goes through to the metal right on the zero point of the A-C sine curve, this eliminates flash, surge, and the so-called peak inrush. A similar cam breaks the weld current just before zero again and the tube contactor automatically holds it until zero is reached and then opens. Again no flash or irregularity because of any natural lag in the opening of the circuit. This is a set-up over which the operator has perfect control and as in the case of welding ordinary steel his vest pocket flexible rule is his guide and check.

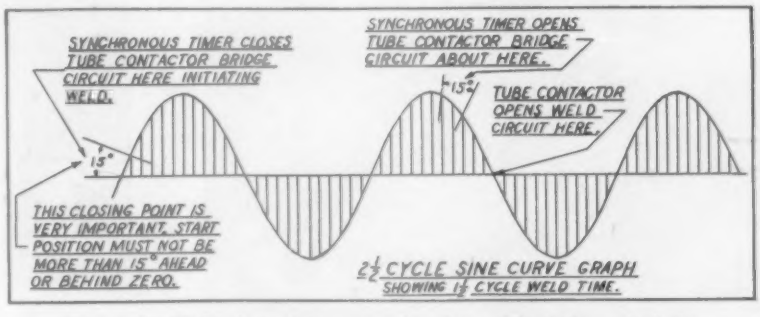
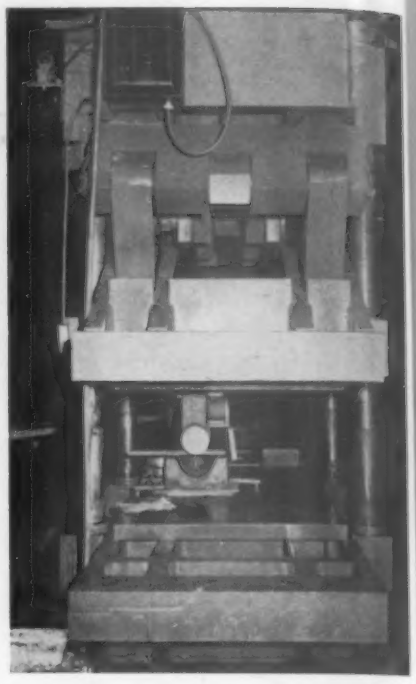

SYNCHRONOUS TIMER CLOSES TUBE CONTACTOR BRIDGE CIRCUIT HERE INITIATING WELD.
SYNCHRONOUS TIMER OPENS TUBE CONTACTOR BRIDGE CIRCUIT ABOUT HERE.
15°
15°
TUBE CONTACTOR OPENS WELD CIRCUIT HERE.
THIS CLOSING POINT IS VERY IMPORTANT. START POSITION MUST NOT BE MORE THAN 15° AHEAD OR BEHIND ZERO.
2½ CYCLE SINE CURVE GRAPH SHOWING 1½ CYCLE WELD TIME.

Figure 7—Weld time sine curve showing critical characteristics.

Unusual Machine Construction Job



Note the heavy plate construction of this 700 ton press. (All photos by Lincoln Electric Co.)

The vital part of welding engineering in the industrial picture and the definite contributions it can make in the present Industrial Defense Program are emphasized in the recent construction of a huge metal forming press in a remarkably short time.

This press, a 700 ton unit, shown in Figs. 1 and 2, was built complete in 35 days from conception of the idea to operation. A huge production machine which was designed and engineered exclusively for arc welded construction. The size of this machine can be appreciated from the fact that the base construction employs 8-inch billets for slide guides and end sections, with 3-inch plate elsewhere.

Because of the wide experience of the builder, R. G. LeTourneau, Inc., an organization which uses only arc welding, plus modern flame cutting equipment for machinery fabrication the construction of the press was not a difficult undertaking. It was simply a case of working out the design for welded construction, cutting the parts from standard plate and shapes and fusing these parts together. Proper procedure control for welding, together with the efficient positioning equipment developed by the builder, made the unusual feat possible.

The press is to be used in fabricating the standard 4-foot by 8-foot panels used in construction of all steel houses of arc welded construction.

An interesting revelation on the practicability of using welding and flame cutting developed as a result of this job. It has shown a way by which aircraft manufacturers and others desiring large presses may obtain them readily despite the congested situation in the machine tool industry.

All welding completed in 3½ days by 4 welders, aided by a set-up man.

It Couldn't Be Done

★ "Authorities" declared that the welding of aluminum castings was impossible by the electric arc process. When the maintenance department of Queens Nassau Transit Lines, Inc., New York City, was given the job of repairing a broken aluminum valve rocker arm cover they proved that this was not the case. When completed, this job was 100% satisfactory and a saving of $15 was effected by using electric arc welding over the conventional repair methods. A total savings of $24 was affected by using welding for repairing the valve cover rather than replacing it with a new cover.

This is just an illustration of one of the many ways in which welding is daily reducing maintenance cost on public transportation systems. In many cases welding makes possible quick repairs which remove equipment from service for only a short period of time, otherwise repairs might require days of work.

Repairingf this aluminum valve cover proved to be an easy welding job.

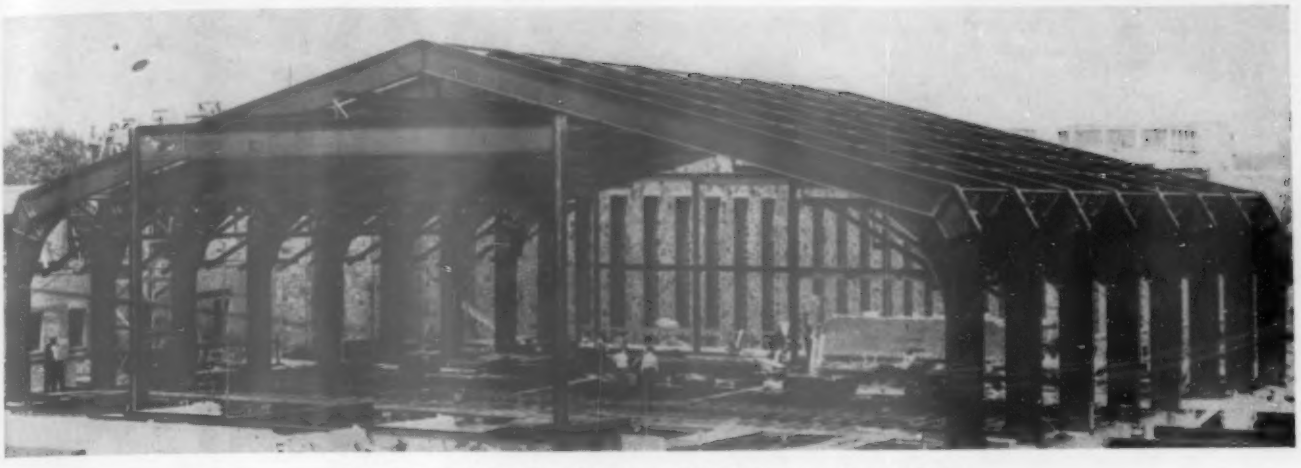


Figure 1—Welded Rigid Frames (Photo Schieve Const. Co.)

Welding Cuts Construction Costs

by

LA MOTTE GROVER

Structural Welding Engineer
Air Reduction Sales Co.

★ Welded fabrication of structural steel will not only speed up our required National Defense construction but will reduce cost. Some of the savings made possible by welded construction are tabulated.

THERE IS under way a large building construction program which will involve a type of steel framing that requires considerable fabricating. This is true both of those buildings required for direct defense construction and those of related construction resulting from industrial expansion. As a result of this widespread building program there will be presented unusual opportunities for the use of structural welding because of the savings in construction cost offered by this process of fabrication.

The type of buildings to be constructed are those that will afford large, open floor areas with a minimum of overhead obstructions to light, ventilation and the operations that are to be carried on within the structure. Systems of structural framing which have recently become most popular in buildings of this design are especially adapted to economical welded construction. An example of this type of construction may be seen in Figure 1.

It is obvious that large unobstructed spaces are required for such structures as hangars, armories, drill halls, gymnasiums, mess halls and structural assembly shops.

Modern shop and factory methods, together with requirements for adaptability to future changes in layout of equipment also require wide unobstructed working bays. The necessity for making adjustments to adapt shop facilities to the production of armaments and war supplies and for readjusting them at a later date for a return to normal production is a further incentive to avoid obstructions that might make such changes difficult. It is not known what future changes in occupancy may be required for many of our government and industrial buildings in case of war time exigencies.

Wide floor areas and shop bays can be spanned most economically with steel rigid frames, arches, or light truss framing in which superflous connecting material has been eliminated by using welded joints and connections. Likewise the size of members may be reduced by fully utilizing material in the most efficient manner. (See Table 1 for the possible saving in weight of steel.)

Much of this defense and auxiliary construction will involve additions and alterations to existing buildings and plant facilities (Figure 2). The expense of field drilling rivet holes in existing steel is eliminated when welding is used. Also, normal operations within the buildings may be continued without interruptions or the moving of machines or equipment as is required in many cases to provide clearances for other methods of construction.

Table I — Percent Saving in Structural Steel Possible for Various Classes of Work Properly Designed for Welding

Class of Structure	Saving
Rigid-Frame or Arched-Roof Large Mill Buildings, Auditoriums, Hangars, etc.	20-26%
Mill Buildings, etc., with Roof Trusses	10-15%
Industrial Handling Equipment	15-30%
Girder and Arch Bridges	15-30%
Truss Bridges	10-20%
Continuous Rolled Beam Bridges with cover plates, splices, stiffeners, etc.	10-15%
Conventional Tier Buildings	5-10%
Class of Member or Unit	
Truss-Type Bents for Mill Buildings	20-30%
Built-Up Plate Girders	20-35%
Light Roof Trusses	15-20%
Heavy Trusses	10-20%

*Cost savings up to 33%

Structural Economy

The lower bids submitted in numerous cases for the construction of properly designed welded structures have proved the economy of structural welding. In rigid frames and arched bents the inherent rigidity of fully developed welded connections provides a special advantage. These "statically indeterminate" types of framing will resist lateral wind loads and support heavy crane girder loads with very little additional steel material over that required for normal gravity loads. A further saving not reflected in contract prices is the reduced cost of cleaning and painting in maintenance and better resistance to corrosion.

The value of providing clean cut, streamlined interiors of pleasing appearance is receiving wide recognition. The smooth lines and surfaces of welded rigid frames and arch members contribute much to good appearance of interiors.

Speed is another factor in favor of welding. Many outstanding records for rapid erection have been established in the construction of a number of welded industrial structures including light truss types as well as rigid frames. Erection speed is of extreme importance under the present circumstances. Field welding can be correlated easily with the progress of other construction operations by merely adding or removing a welding operator at any time. Then, too, these welding operators can be moved from point to point about the job with a minimum amount of handling or moving of equipment.

Shop equipment for welded fabrication is equally well adapted to plate girder construction and to truss construction utilizing rolled sections. When mill deliveries cannot be obtained for one class of material, a change in design can be made with a minimum of inconvenience. This is likely to be an important factor in the near future. Without welding, a shop might find its capacity for one class of work entirely filled while it has available capacity for another class but cannot make use of it. Also many classes of welded fabrication can be carried out almost entirely outdoors in the shop yard except for brief periods of inclement weather.

Delay Avoided

In welded fabrication, production capacity can be built up quickly with a minimum amount of expense to meet emergencies. In the same way that increased production during the 1917-18 emergency provided the first great impetus to the use of welding in shipbuilding and mechanical engineering construction, we can expect the present expansion in the building construction field to be accompanied by a great increase in welded construction. The foundation has been well laid for structural welding during the last ten or twelve years with the sucessful completion of hundreds of welded buildings and quite a number of welded bridges throughout the country.

Fig. 2—A Welded Addition to an Existing Plant

The welding industry is contributing extensively in its field toward the training of skilled workmen to help relieve the shortage of skilled labor that is keenly felt in all kinds of construction and manufacturing work, and technical services and assistance are being furnished to work out new problems of welding in production that are arising in connection with defense construction, upholding the oustanding record for such service that was established during the world war of 1917-18.

» «
(Also See Page 45)

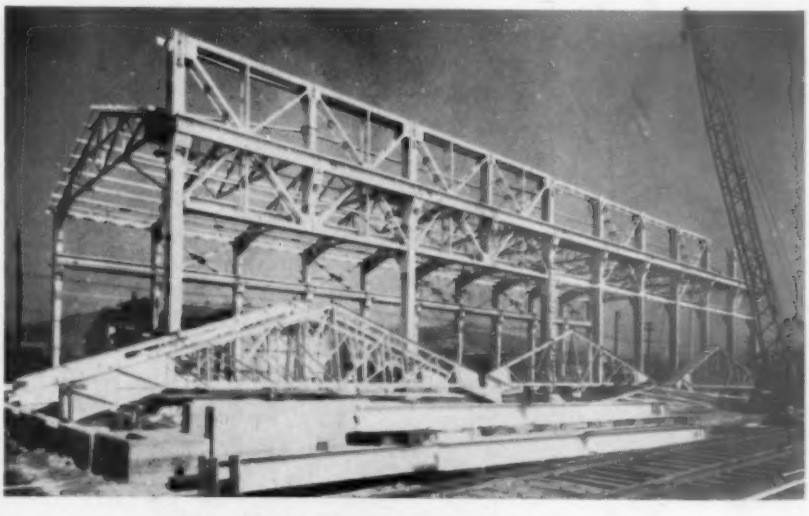


Fig. 3—Welded Truss-Bents (Photo Dravo Corp.)

★ALLOYS

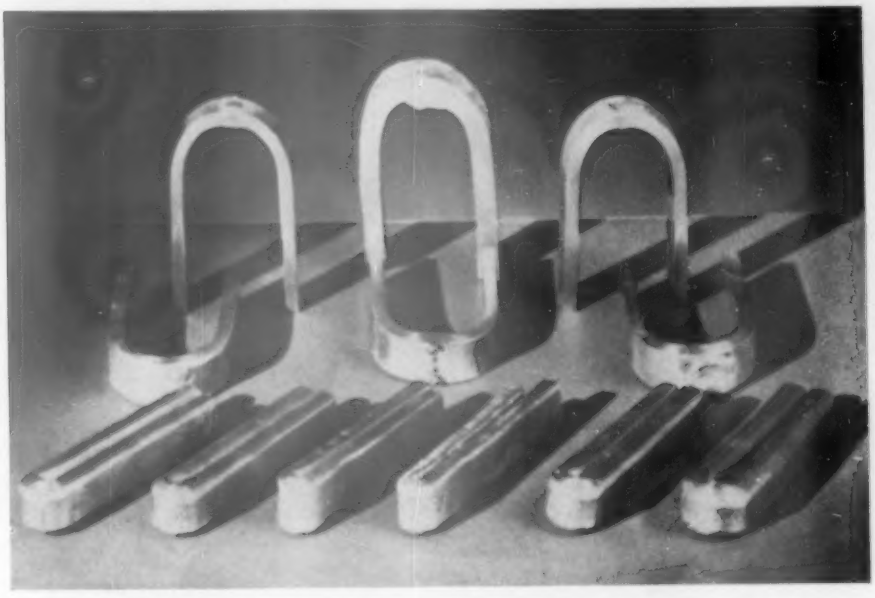


Fig. 1—Typical free bend and force bend samples made on red brass plates. Note the face and root bends. All bend samples bent through 180 deg.

FUSION WELDING OF RED BRASS

J. BABIN and J. J. VREELAND
Welding Engineers
Chase Brass and Copper Co., Inc.

★ Brass and copper has long been joined by brazing but now true fusion welding of these material is possible. The theory and advantages of this new welding possibility are explained.

FOR MANY years the term welding has been incorrectly used to denote various methods by which metals are joined, either by gas or electric arc methods. In a good many instances it was termed welded when it was brazed joints, not fusion joints, that were actually made. The metals to be joined were simply heated to a temperature of approximately 100 to 200 deg. Fahrenheit superheat, which is the amount of heat in excess of the melting point of the filler rod, permitting the rod to "wet", or adhere to, the sides of the parent metal. Figure 2 is a photomicrograph of a brazed joint. Figure 3 is a similar view but taken at a higher magnification, to show the absence of any intercrystalline bond. This is especially true when yellow brass brazing rods (more commonly referred to as "bronze" rods) are used. This family of brazing rods (Naval Brass, and others) has found wide application in joining metals whose melting points are considerably higher than that of the filler rod used.

Fusion welds are obtained only when the edges of the parent metal have been brought to a molten condition, permitting fusion with the filler metal. An intercrystalline bond is obtained, one in which the grains of both the parent and filler metals have grown together. Such a bond is illustrated in Figure 4 and 5. If the correct welding procedure has been followed, welded samples tested in tension will seldom, if ever, fail along the angle of mitre.

Until a relatively short time ago, yellow brass pipe was used in municipal and industrial buildings for water and heating lines. Large diameter pipe was joined either with threaded fittings or by brazing with the so-called "bronze" filler rods. Yellow brass itself did not stand up too well under certain conditions, since it is susceptible to a type of corrosion failure known as dezincification. To combat this weakness red brass pipe was substituted, but all joints were still brazed with a yellow brass rod. As long as this corrosive condition existed, the attack would be concentrated on the filler metal, which is the point where failure might be expected to occur. The strength and ductility of this type of joint were not very good. Samples taken from brazed pipes were tested in tension, and invariably the break occurred at the junction of the weld and parent metals. When subjected to bend tests, the sample parted along the angle of mitre, and before any appreciable amount of bending occurred.

The need for a rod which would not only offer resistance to corrosive attack but would also make it

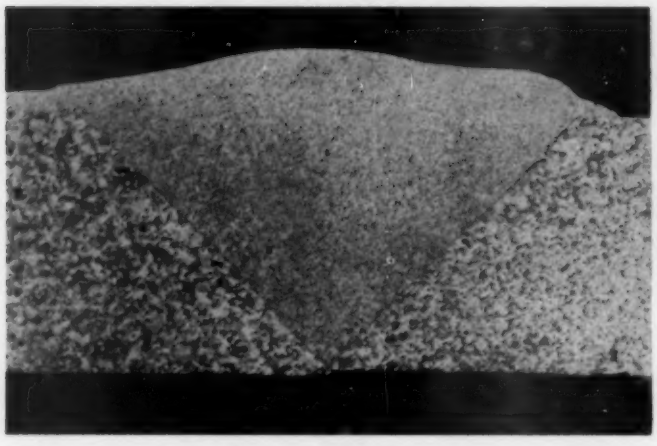


Fig. 2—A True Braze or "Bronze-Weld" on ½" Red Brass Plate. Note the sharp line between braze and base metal. Strength of joint approximately 30,000 p.s.i.

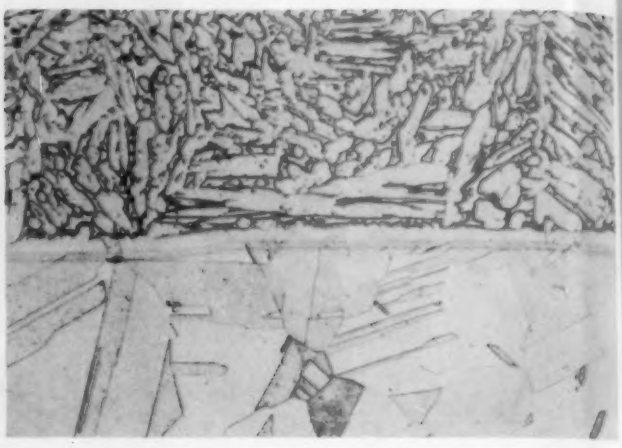


Fig. 3—Junction of "Bronze-weld" shown in Fig. No. 2.

possible to obtain fusion welds of high strength and ductility was very apparent. This need was particularly important, since welded construction had been approved by certain municipal engineering boards and the U. S. Navy. The rod was also to possess a degree of fluidity which would permit its use for welding in all positions.

To meet these requirements a low-silicon bronze rod that has a nominal composition of 97.50% Copper, 1.5% Silicon, and 1.0% Zinc has been developed. Because of the ease with which this rod can be handled, a small pool of weld metal can be maintained under the torch, assuring fusion with the side walls of the parent metal. For best results a flux specially designed for silicon bronze gas welding should be used with this rod. For ease of application the flux should be mixed with alcohol to form a paste and then painted on both the base metal and welding rod. If more flux is needed it can be sprinkled on during the welding operation.

In the oxyacetylene welding of red brass pipe and of plate from ⅛ in. to and including ⅜ in. in gage, the edges to be joined should be beveled on a 45 deg. single mitre. On gages over ⅜ in. best results are obtained by using a 37½ deg. single mitre. For closer control of the weld metal, so that fusion with the side walls is obtained on gages ¼ in. and heavier, it is recommended that either a preheating torch or an auxiliary torch be used. Figures 3 and 4 show gas welds on ½ in. red brass plates made with aforementioned low-silicon bronze rod. Table I lists some recommended procedures and results obtained with this method of welding. Fig. 1 shows free bend and force bend samples of welded pipe and plate. The high degree of ductility of the weld is clearly indicated.

Fusion welds can also be obtained on red brass by the carbon arc method of welding. Although high thermal stresses set up during welding it is strongly recommended that the high silicon bronze welding rod be used. This rod has a nominal composition of 97% copper and 3% silicon, and is designed specially for carbon arc welding. Regular silicon bronze carbon arc welding flux should be used and applied in the conventional manner. When using this method on gages 3/16 in. and over best results are obtained by beveling the edges to be joined on a 45 deg. single mitre and multiple bead welding. A grooved copper backup bar should be used for gages under 3/16 in. Figures 6 and 7 show a carbon arc weld on ½ in. red brass plate using this high silicon bronze welding

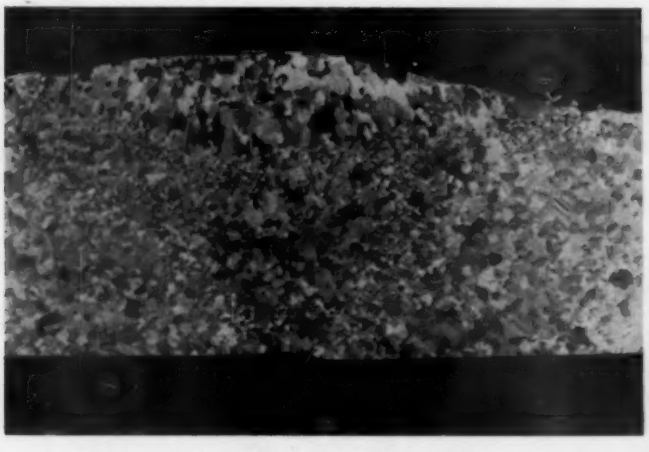


Fig. 4—Oxyacetylene Weld on ½" Red Brass Plate using Low-Silicon Bronze Welding Rod. Note intergranular bond and uniformity of grain structure indicating fusion of weld and base metals.

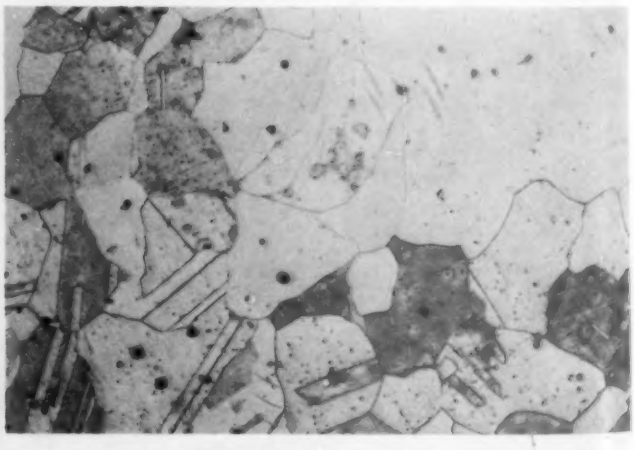


Fig. 5—Junction of Weld Metal and Base Metal showing the intergranular bond as shown in Fig. 3.

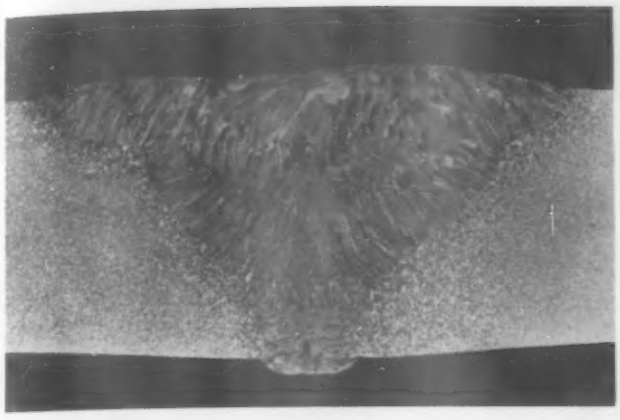


Fig. 6—Carbon Arc Weld on ½" Red Brass Plate, using High-Silicon Bronze Welding Rod. Note the small effect of welding on the Base Metals.

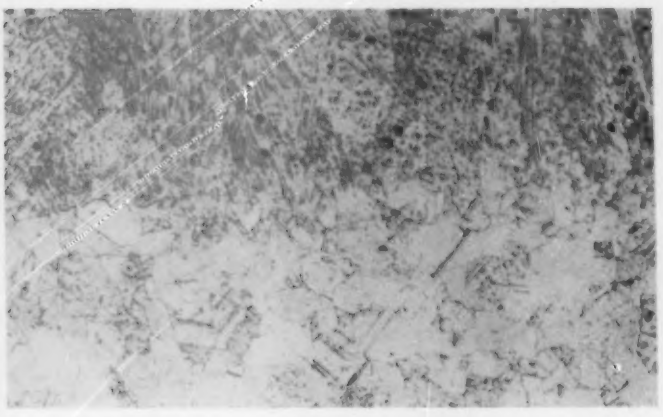


Fig. 7—Junction of Weld Metal and Base Metal showing the intergranular bond existing between Weld and Base Metal as shown in Fig. 6.

rod. The results obtained on the ½ in. thick red brass plate were very satisfactory and it can be assumed that results on thinner gages would be equally good. Table II shows the recommended procedure for carbon arc welding ½ in. red brass plate and suggested procedure for other gages. Additional work will be done to determine the correct procedure for carbon arc welding of various gages of red brass plates.

Summarizing this brief discussion it may be said that on fusion welding of red brass satisfactory welds may be made with the oxy-acetylene torch, using a specially developed low silicon bronze rod and a flux specially prepared for this type of welding. If a weld is to be made by the carbon arc method, a high silicon bronze rod should be used, with a special carbon arc flux designed for carbon arc welding with silicon bronzes.

Table I
Oxyacetylene Welding Red Brass

Form	Thickness	Type Weld	Mitre	Torch Tip	Filler Rod Type	Filler Rod Size	Tensile Strength P.S.I.	Free Bend %
2" SPS Pipe	5/16"	Rolling	45°	No. 9	Low Sil. Brz.	3/32"	38,200 R	
6" SPS Pipe	¼"	Rolling	45°	No. 12*	Low Sil. Brz.	1/16"	{37,700 R	
		Stationary	45°	No. 10	Low Sil. Brz.	1/16"	{35,300	
		Vertical-Horiz.	45°	No. 10	Low Sil. Brz.	1/16"	{37,300 R	
4" Ex. Hvy. Pipe	0.341"	Stationary	45°	No. 10 Weld.	Low Sil. Brz.	1/16"	{35,500	
Plate	½"	Forehand	37½°	No. 10 Aux.			{37,200 R	
				No. 12 Weld.	Low Sil. Brz.	¼"	{35,500	
				No. 10 Aux.			{36,900 R	
							{36,000	
							{37,000 R	61
							{34,000	

No. *—No. 10 tip used on preheating torch for 6" SPS pipe.
R—Indicates reinforced weld.
Tensile strength ½" Red Brass plate material, 44,000 psi.

Table II
Carbon Arc Welding Red Brass

Thickness Base Metal	Mitre	Root Aper.	Filler Rod Type	Size	Carbon Dia.	Closed Circuit Amps.	Closed Circuit Volts	Tensile Strength P.S.I.	Free Bend %
1/8"		3/32"	High Sil. Brz.	1/16"	1/16"	180-220	30-35		
3/16"	45°	1/16"	High Sil. Brz.	3/32"	¼"	150-190	25-30		
				1/16"	5/16"	180-220	30-35		
¼"	45°	1/16"	High Sil. Brz.	1/16"	5/16"	170-210	30-35		
				¼"	3/8"	200-260	30-35		
3/8"	45°	3/32"	High Sil. Brz.	1/16"	3/8"	180-220	28-30		
				¼"	3/8"	200-260	30-35		
				¼"	½"	240-300	30-35		
½"	45°	3/32"	High Sil. Brz.	1/16"	3/8"	200-220	28-30		
				¼"	3/8"	240-260	30-33	{41,700 R	
				¼"	½"	300-320	33-35	{37,650	65
				*{3/16"	½"	300-320	33-35		
				{¼"	½"	320-340	33-35		

*Parallel beads used to minimize heat effect on base metal
R—Indicates reinforced weld.
Tensile strength of ½" red brass base metal, 44,000 p.s.i.

★ PROGRESS

Figure 1—"Stove-pipe" welding is used in rough terrain.

ARC WELDED PIPELINE CONSTRUCTION

by

C. M. TAYLOR

Vice-president
Lincoln Electric Co.
Cleveland, Ohio

★ The past ten years has seen many changes in methods of pipe line construction. Here is found a review of the changes in joint design as well as data on pipe line construction by the electric arc method.

ONLY A SMALL percent of the welded pipelines constructed in this country prior to 1930 were fabricated by arc welding. About that time, however, the advent of the heavily coated welding electrode began an increase in the use of the arc welder as a tool for joining pipelines used in carrying oil, gasoline, natural gas and water across the nation.

Design Changes

The use of arc welding in pipeline construction lead to many changes in joint design. In Figure 2 is shown the bell and spigot type joint which was commonly used with the bare wire welding electrode. About 1930 the double bell joint (Figure 3) with liner was adapted for oil pipelines. This type of joint was used for about 3 years.

The plain end joint shown in Fig. 4 was introduced in 1933 for oil line construction. Up until 1938 it was used only on lines as large as 12 inches. However, due to proved economies and highly satisfactory service of more than one million arc welded joints in service, this simple type of joint has now been extended to pipe as large as 16-inch diameter. Resultant economies in construction and operation of oil lines are apparent.

The plain end joint with liner (Fig. 5) is used almost exclusively for gas lines up to and including those 24 in. in dia., because the resistance to flow caused by the liner is negligible and because this type of joint in larger size pipes is most economical. On this type joint two beads are required.

Modern Practice

Modern practice in the construction of oil and gas lines, using the plain end joint with liner for gas lines, and the plain end joint without liner for oil lines has placed pipeline construction on a production line basis. The following is a general description of the job:

Out in front of the entire construction gang goes the line-up and tacking crew. Aided by a tractor and hoist, they line-up the pipe lengths on dollies for rolling during welding. The tack weldor then tacks the adjacent lengths of pipe together usually at four points on the circumference. As many lengths are joined as the nature of the line and the contour of the terrain will permit. The long tack-welded section is then left on the dollies ready

or the firing line welders who follow close behind.

The "Firing Line"

The firing line crew, including several weldors, completes the welds of the long sections. These operators weld at the top of the pipe while a helper turns the pipe by means of a chain pipe wrench. All welding is done in a flat, downhand position, and by using large-size electrodes (¼ in., $\frac{5}{16}$ in. and sometimes ⅜ in.) and heavy welding current, high welding speeds are obtained. After the completion of each bead, a helper cleans all of the slag from the weld. Each completed weld is inspected for imperfections before the weldor proceeds to the next joint. When the section is entirely welded, the pipe is rolled off the dollies and the pipe sections are painted and then joined into a continuous stretch by "bell-hole" welding.

This pipe is now placed on timber skids near or over the trench and, in this position, it is "bell-hole" welded (Fig. 7). Instead of having the pipe rolled beneath the arc, the weldor now plies the arc around the pipe. For these welds, he uses smaller sized electrodes ($\frac{5}{32}$ in. or $\frac{3}{16}$ in.) with 100 to 200 amperes current.

In the construction of oil and gas lines in rough terrain, very muddy or sandy country, the "stove-pipe" method is frequently employed. In this case all joints (usually plain end without liner) are position-welded like bell-hole joints. One joint at a time is added to the line; this makes it possible to reduce the size of the crew and equipment required and to keep all operations under one supervisor. During alignment and tacking, the joint is usually held in place by a line-up clamp or "grasshopper" as is shown in Fig. 6. After tacking, two bell-hole weldors work simultaneously on both sides of the joint, making the complete first bead, each weldor coming down from the top. This type of construction is illustrated in Fig. 1.

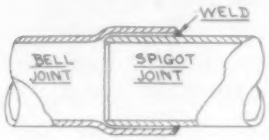


Fig. 2—Bell and spigot type joint, used back in the days of bare wire electrode.

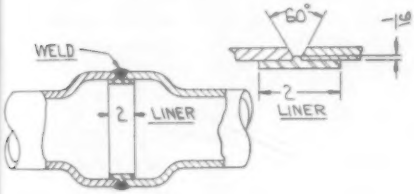


Fig. 3—Double bell joint with liner commonly used on oil pipelines built between 1930 and 1933.

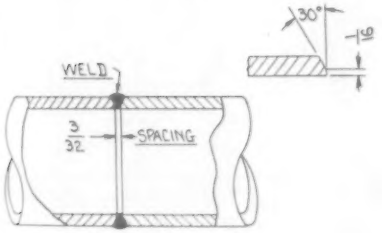


Fig. 4—Plain end joint without liner, now used extensively on oil pipelines as large as 12 in. Three beads are required.

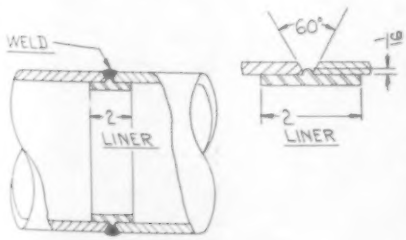


Fig. 5—Plain end joint with liner, used for gas pipe lines as large as 24 in. Two welding beads required.

River Crossings

On cross country pipelines, the contractor must be prepared to meet and overcome any existing hazard. One of the most common of the hazards encountered is that of crossing rivers and streams for the problems of such a crossing are many. If the stream is navigable, that portion of the line constituting a river crossing must be buried to avoid possible damage from river traffic, in which case a trench must be dredged across the river. If the pipeline is not buried, it must be securely anchored so that it will not be carried away by flood currents. Likewise, this portion of the line must be heavier and better protected because of the more corrosive conditions existing where it is laid.

For river crossings the wall thickness of the pipe is generally 50% to 100% greater than that used in the rest of the line. This pipe is roll-welded and bell-hole welded into a section long enough to cross the river on shore. Each joint is usually reinforced by a welded-on sleeve. Special river

Fig. 6—A line-up clamp is of considerable assistance during tacking operations.

Fig. 7—Bell hole welding over the pipe trench.

TABLE I — ELECTRODE SIZES

Size Pipe	Stringer Bead	Second Bead	Third Bead
Roll Welding Without Backing-Up Ring			
4"	5/32"	1/4"	1/4"
6"	5/32"	1/4"	1/4" or 5/16"
8"	5/32" or 3/16"	1/4"	1/4" or 5/16"
10"	5/32" or 5/16"	1/4"	1/4" or 5/16"
12"	5/32" or 5/16"	1/4"	5/16" or 3/8"
Roll Welding With Backing-Up Ring			
6"	1/16" or 3/32"	1/4"	
8"	3/32" or 1/4"	1/4"	
10"	1/4" or 5/16"	5/16" or 3/8"	
12"	1/4" or 5/16"	5/16" or 3/8"	
14"	5/16"	5/16" or 3/8"	
16"	5/16"	3/8"	
18"	5/16"	3/8"	
20"	5/16"	3/8"	
22"	5/16"	3/8"	
24"	5/16"	3/8"	
26"	5/16"	3/8"	
Position Welds Without Backing-Up Ring "Stove-Pipe" or "Tie-In" Method			
6"	5/32"	3/16"	3/16"
8"	5/32"	3/16"	3/16"
10"	5/32" or 3/16"	3/16"	3/16"
12"	5/32" or 5/16"	3/16"	3/16"
Position Welds With Backing-Up Ring			
Use 3/16" rod for all beads on all sizes of pipe.			

TABLE III — AMOUNT OF ROD USED TO WELD VARIOUS SIZE PIPE

Less Without Ring Due to Close Spacing
Thickness of Pipe — 1/4" to 5/16"

Size Pipe	Pounds Rod Per Weld With Ring	Without Ring
6"	1.00	.75
8"	1.50	1.00
10"	2.00	1.25
12"	2.25	1.50
14"	2.50	1.75
16"	2.75	2.00
18"	3.00	2.25
20"	3.25	2.50
22"	3.50	2.75
24"	3.75	3.00

TABLE IV — SPACING OF PIPE JOINT FOR WELDING

Roll and Position Welding With Backing-Up Ring
(All size pipe spaced from 1/16 to 3/32 in.)

Size Pipe	Average Spacing
4"	1/16 to 1/8"
6"	1/16 to 1/8"
8"	1/16 to 1/8"
10"	1/16 to 1/8"
12"	1/16 to 1/8"
Position Welding Without Backing-Up Ring	
Size Pipe	**Average Spacing**
6"	1/16"
8"	1/16"
10"	1/16"
12"	1/16"

TABLE V—AMPERAGE AND VOLTAGE FOR VARIOUS SIZES OF ROD

ROLL WELDING

Size Rod	Amperage	Voltage
1/8"	100-250	30-40
5/32"	125-200	30-40
3/16"	150-225	30-40
7/32"	175-300	30-40
1/4"	200-325	30-40
5/16"	250-400	30-40
3/8"	350-500	30-40
POSITION WELDING		
1/8"	100-250	25-40
5/32"	125-200	25-40
5/16"	125-200	25-40

clamps, four to ten feet long and weighing 1000 to 3000 lbs. each are often bolted to the pipe at intervals, serving as a means of anchoring. The pipe section is then attached by cable to tractors and pulled across the river or placed onto pontoons from which it is guided by stakes into a dredged cut across the river bottom.

The following tables give recommended procedure and speeds for arc welding of oil and gas lines. The values shown are based on pipe of 1/4 in. wall thickness when working in favorable terrain and good weather conditions where the equipment can be moved readily and the pipe joints lined up and made ready for speedy work.

TABLE II — AVERAGE SPEEDS OF PIPE LINE WELDING

(The following data is not the actual time consumed in making each individual weld, but is the average time consumed in making all welds on an average length pipe line from start to finish of the job, and includes delays, break-downs and moving time. In other words, it is the average production that cen be expected per welder, per hour on pipe line construction.)

Size Pipe	Average Welds Per Hour
Roll Welding Without Backing-Up Ring (Three Beads)	
6"	6.0
8"	5.5
10"	4.0
12"	3.0
16"	2.5
20"	2.25
22"	2.1
24"	2.0
Roll Welding With Backing-Up Ring (Two Beads)	
6"	7.0
8"	7.5
10"	5.0
12"	4.5
14"	4.0
16"	3.5
18"	3.25
20"	3.2
22"	3.1
24"	3.0
26"	2.5
Position Welding (Stove Pipe Method) Without Backing-Up Ring After 1st Bead Run by Tackers	
6"	5.0
8"	4.0
10"	3.0
12"	2.0

Pipe Lines (Water)

As in the case of oil and gas lines, arc welding assures permanently tight, leak-proof joints which are stronger than the pipe itself. A large number of water lines and penstocks in sizes up to 20 feet diameter have been field welded by the arc process. The type of welded joint used in water lines depends upon the size and thickness of pipe and the operating pressure of the line. In the smaller size lines (up to 36 in. to 56 in.) the bell and spigot type joint, welded from the outside only is used. Larger size lines such as the 108 in. line shown in Fig. 8 have plain butt joints with reinforced band which is welded on both ends. In this type joint the walls are beveled and welded on the inside.

Roll welding is impractical in water line construction because of the large diameter pipes used. The circumferential joints, joining sections which are relatively short, are made in position or in a manner similar to that used in bell-hole welding. An example of this is shown in the construction of the 18 in. line pictured in Fig. 9. This This line was position welded with a minimum of equipment yet at the surprising speed of 103 joints per day on a 53 mile run.

Table VI gives data pertaining to the welding of girth seams for large diameter pipe used in the construction of siphons.

Fig. 8. — Welding a reinforcing band on a 108 in., dia. butt welded water line.

Fig. 7—Arc welding an 18-inch gas line in Utah—total 53 miles, 6729 butt joints with back-up ring. Welded by firing line and bell-hole method an average of 103 joints per day.

TABLE VI — WELDING DATA FOR LARGE DIA. (SIPHON) PIPES

Length of Siphon (feet)	Diameter (inches)	Plate Thickness (inches)	Inside of Girth Joints Type of Weld	How Welded	** Current	*Lbs. Rod Per Joint	Outside of Girth Joint How Welded	** Current	***Welding Speed
8000	84	1/4	Square Butt	Manually	38V250A	5¼ lbs.	Automatically	34V350A	1.32 Ft/Min.
	84	5/16	Square Butt	Manually	38V250A	5¼ lbs.	Automatically	35V400A	1.32 Ft/Min.
	84	3/8	Square Butt	Manually	38V250A	5¼ lbs.	Automatically	38V600A	1.32 Ft/Min.
2800	81	5/16	Square Butt	Manually	38V250A	5 lbs.	Automatically	35V400A	1.32 Ft/Min.
1800	52	1/4	Square Butt	Manually	38V250A	3.3 lbs.	Automatically	34V350A	1.32 Ft/Min.
	52	5/16	Square Butt	Manually	38V250A	3.3 lbs.	Automatically	35V400A	1.32 Ft/Min.
	52	3/8	Square Butt	Manually	38V250A	3.3 lbs.	Automatically	38V600A	1.32 Ft/Min.
1000	111	1/4	Square Butt	Manually	38V250A	7.0 lbs.	Automatically	34V350A	1.32 Ft/Min.
	111	5/16	Square Butt	Manually	38V250A	7.0 lbs.	Automatically	35V400A	1.32 Ft/Min.
	111	3/8	Square Butt	Manually	38V250A	7.0 lbs.	Automatically	38V600A	1.32 Ft/Min.
300	96	1/4	Square Butt	Manually	38V250A	6.0 lbs.	Automatically	34V350A	1.32 Ft/Min.
	96	5/16	Square Butt	Manually	38V250A	6.0 lbs.	Automatically	35V400A	1.32 Ft/Min.
	96	3/8	Square Butt	Manually	38V250A	6.0 lbs.	Automatically	38V600A	1.32 Ft/Min.

*Includes Tack Welding.
**V=volts. A=amperes.
***The pipe was set to rotate at about the same speed, that is, 1.32 feet per minute for welding all thicknesses with the automatic welder, the depth of penetration of the weld being controlled by the current. The current setting was about as shown in the table.

Brief Sketches of Welding Jobs

6 ft. diameter fabricated gear for punch press. (Photo General Electric Co.)

A-C Welding Saves Time and Money in Gear Replacement

★When a 6-foot, cast-iron punch press gear failed recently, the Menna Welding Co., Toledo, Ohio, saved its owner at least $100 and perhaps 3 weeks production time by fabricating this replacement of boiler-plate steel. With the aid of a 500-ampere a-c arc welder, the welding of this replacement was completed in 12 hours.

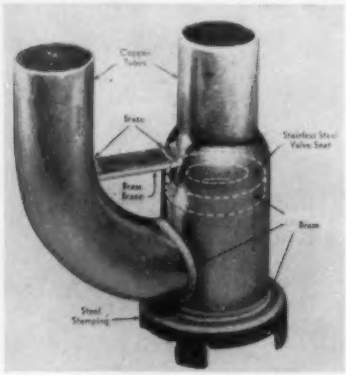
It would have taken a full 48 hours to secure a new cast-iron gear, assuming the pattern was available. If the pattern were not available, 3 or 4 weeks would have been required to obtain the new gear.

The complete cost of the arc-welded gear supplied by the Menna Welding Co. was less than $300—a saving of $100 when compared to the cost of a new gear. The amount saved would be greatly increased if the avoided shutdown losses were included.

» «

Silver Alloy Brazed Parts Replace Castings

★Silver brazing alloys are opening up fast, economical ways of making parts for many purposes which, not very long ago, would have called for castings. The heater valve body illustrated, for example, was assembled entirely by brazing. It is made of two pieces of tubing with 20 B. & S. gauge walls, a brass bracing piece between the curved and straight tubes, a stamping of steel at the base and a valve seat of stainless steel inserted inside the large diameter of the straight tube. The entire part was set up, fluxed, the brazing alloy preplaced and then the assembly was put in a furnace and brazed in one operation. The brazing alloy used was a silver alloy which has a medium silver content and flows freely at 1175 Deg. F. Rings of wire were preplaced around the joints to be made before heating. In addition to eliminating casting and the machining of parts, this alloy also joins several dissimilar metals. In this instance copper, brass, steel and stainless steel were permanently bonded together. Joints in this case must be leak-tight. It is reported that finished parts, which are being made in quantity, are coming through very satisfactorily with a very low percentage of rejects.



Five metals yet one piece. (Photo Handy & Harman)

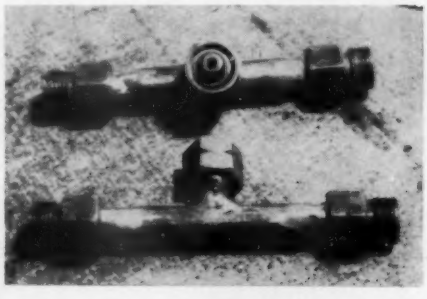
» «

Handy Hose Connections

By Art Havens

★There are a great many aggravating situations that arise in the life of a railroad welder. One of the most provocative is having to climb in and out of a firebox to turn off oxygen and acetylene tanks or back pressure valves before and after changing from cutting torch to welding torch, only to repeat the performance about fifteen minutes later. To one that has not worked on locomotives, this may seem like a trivial matter but to a welder, repairing a superheater unit where the torches must be changed forty or fifty times a day, climbing in and out becomes a very tiresome procedure.

A weldor in a railroad shop has solved this problem in a simple manner. To two 3 in. long ⅜ in. pipe nipples he brazed three hose fittings. A male fitting was brazed on each end and in the center a female fitting. One of these special nipples was made with connections right handed for an oxygen hose and the other left handed for the acetylene hose. Now with these connections fastened on the end of a pair of hose, a wye branch is formed. Then by running two short lengths of each type of hose from each end of the fittings it is possible to arrange to have both cutting and welding torch connected at all times to the same tanks or station. Such an arrangement saves changing torches each time a different torch must be used.



These connectors help the welder.

» «

Locomotive Valve Repair

★One of the type K locomotives of a small New England railroad was recently laid up because of a broken valve spool. Confronted with the possibility of losing the service of this much needed locomotive until a new valve spool could be cast, it was decided that one should be obtained by some other means, if possible. Finally it was decided to fabricate a new spool using steel plate and arc welding. Having the pieces of the broken spool for a pattern, a boiler maker rolled the parts to shape. The tapered ends and the center section were made from ⅜ in. steel plate while the ends were made from ⅝ in. plate to allow for machining. The construction of this valve spool by this method was found to be so efficient and inexpensive that it now has been accepted as a standard practice. In fact, all the valve spools required for this railroad are now fabricated from plate instead of being obtained by casting.

Making a Valve Spool.

Brief Sketches of Welding Jobs

Fuel Tanks Fabricated By A-C Welding

★ Fuel tanks for road machines are produced in numbers by the Angle Products Co., Cleveland. They are usually fabricated of 12-page terne-plate steel having two longitudinal seams, a seam around each end and a seam around the sediment sump at one end. Three baffle plates are welded inside in a transverse position to minimize movement of the fuel. On completion, each tank of this type is tested under a pressure of 25 pounds per square inch.

200 ampere A-C arc welder is used in fabrication of this 60-gallon fuel tank. (Photo General Electric Co.)

» «

All-welded Safety Crossing

By M. T. Pate

★ A welder for a drilling contractor constructed, from short lengths of angle iron, pipe and expanded metal, a safety cross-over to span high-pressure steam and water lines. Thereby providing a safe passage for workmen who otherwise might be tempted to risk a short cut across the three parallel pipe lines.

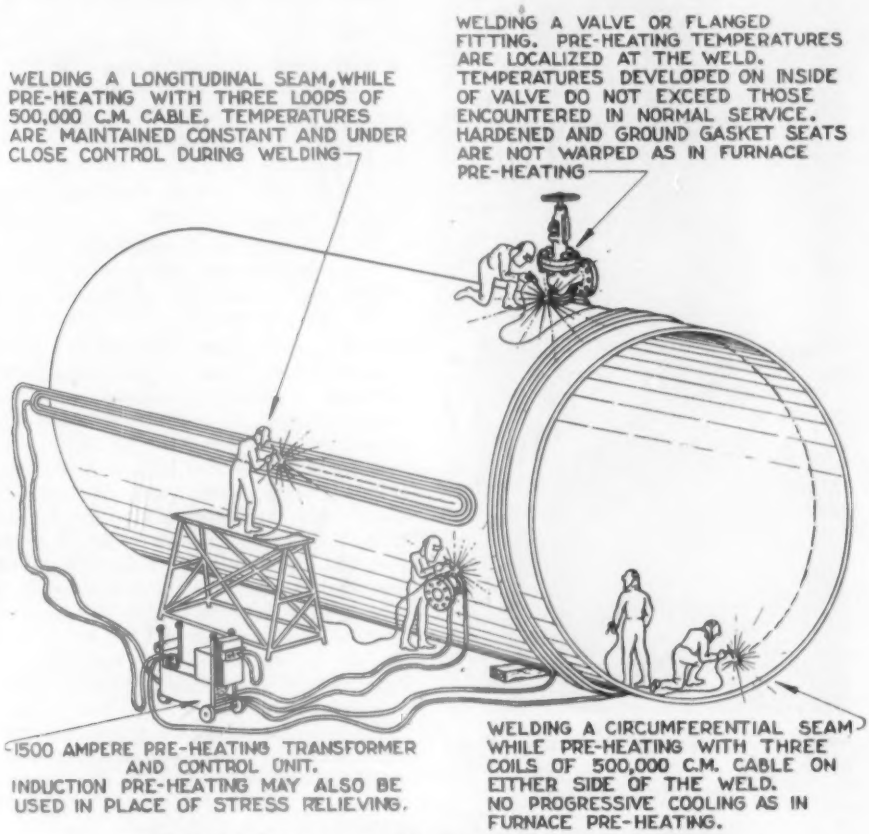
Two rectangles, built up of 1½" angle iron, formed the twin bases of this cross over, with risers of the same material forming the arch over the pipe lines. Paired formed railings of pipe were welded to the outer corners of the base served to support the steps. The entire cross-over unit is light and can be easily loaded on a truck for removal to another location. Nevertheless it serves as constant reminder to workmen to use the safe crossing instead of risking footing on the hot and perhaps slippery pipes.

Induction Preheating for Pressure Vessels

★ The United Engineers & Constructors, Inc. recently completed a very interesting pressure vessel welding job at the Public Service Co. of N. J. Burlington Plant. The unusual feature of the work was the manner in which a large condensor drum 30 ft. long, 20 ft. in diameter of 1 in. thick steel was preheated for welding.

The preheating of both the longitudinal and circumferential joints was done by induction hysteresis using a 1500 ampere preheating single unit transformer and control. The 30 ft. lengths were preheated with three complete turns laid longitudinally along the section to be cut or welded, using about 175 feet of 500,000 circular mills cable. The cable is simply laid in an elipse, three turns per side, close together, with an opening in the center where the work is done. It is not necessary to hold the cable in position except at the end as magnetic attraction seems to glue it to the work once the current is on.

Below is seen an artist's conception of the preheating and welding operations on this large condenser drum.


WELDING A LONGITUDINAL SEAM, WHILE PRE-HEATING WITH THREE LOOPS OF 500,000 C.M. CABLE. TEMPERATURES ARE MAINTAINED CONSTANT AND UNDER CLOSE CONTROL DURING WELDING
WELDING A VALVE OR FLANGED FITTING. PRE-HEATING TEMPERATURES ARE LOCALIZED AT THE WELD. TEMPERATURES DEVELOPED ON INSIDE OF VALVE DO NOT EXCEED THOSE ENCOUNTERED IN NORMAL SERVICE. HARDENED AND GROUND GASKET SEATS ARE NOT WARPED AS IN FURNACE PRE-HEATING
1500 AMPERE PRE-HEATING TRANSFORMER AND CONTROL UNIT. INDUCTION PRE-HEATING MAY ALSO BE USED IN PLACE OF STRESS RELIEVING.
WELDING A CIRCUMFERENTIAL SEAM WHILE PRE-HEATING WITH THREE COILS OF 500,000 C.M. CABLE ON EITHER SIDE OF THE WELD. NO PROGRESSIVE COOLING AS IN FURNACE PRE-HEATING.

PRE-HEATING A HEAVY PRESSURE VESSEL

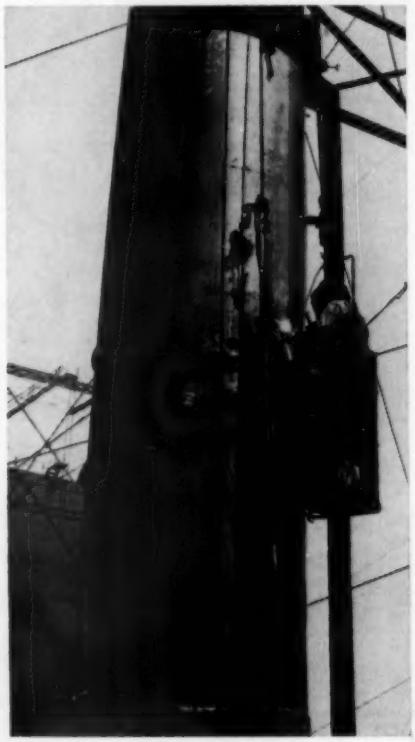
1 INCH THICK, 30 FEET LONG, 20 FEET IN DIAMETER WITH THE INDUCTION HYSTERESIS SYSTEM AS INSTALLED AT THE BURLINGTON PLANT OF THE PUBLIC SERVICE CO. OF N.J.

A crossing of welded construction makes for safety.

Brief Sketches of Welding Jobs

Old Stack Saved by Electric Welding

★ In what is believed to be the first of its kind ever attempted, an ingenious electric welding job has saved a large public utility company from a possible plant shutdown with its accompanying financial loss, plus the additional cost of entirely new boiler stacks. Even neglecting a plant shutdown which would have been ruinous, repairs were made to two badly corroded 75-foot steel stacks by electric welding for less than ⅓ the estimated cost of new stacks.



While this welder is "up in the air" he is keeping maintenance cost down. (Photo Westinghouse)

Engineers upon inspecting two of the company's three 20-year old steel stacks found that the ⅜ in. thick steel center plates had been corroded until they were less than 1/64 in. thick; in some places were found a full ¼ in. of rust. Corrosion caused was the corrosive action of combustion products from the forced draft coal fired boilers.

The problem of supporting the top half of the stack so that the corroded plates could be removed was solved by welding offset steel angles across the faulty section. The old plates were now cut out, leaving the stack's upper portion supported only by the angles. This is believed to be the first time such a method of support has ever been employed for a welding job of this kind. The job was now ready for the welders with new steel plates. Working swiftly, they welded in place on each stack eight —9 ft. x 4 ft. x ⅜ in. plates. Three inch vertical overlaps were made at the junctures of the old and new steel.

During the time the center section plates were removed, the boilers were shut down, but before completion of the welding, they had been re-fired. If a new brick chimney had been built, or new steel stacks provided for replacements, the boilers would have had to shut down completely while breeching was being installed or stacks were erected.

» «

Steam Hammer Piston Rod Repair

By Art Havens

★ A railroad blacksmith shop without a steam hammer! Seems strange, doesn't it, yet that was nearly the situation in a shop on a small railroad in New England when the 5 in. piston rod on a 3500 lb. single arch steam hammer broke while drawing out a locomotive side rod.

The blacksmith foreman questioned the engineering and purchasing departments and found that it would take weeks to get a new piston, since the rod and piston were in one piece on this type hammer. True, a new piston could be made but the blacksmiths could not draw one out of a billet without the steam hammer.

The job was finally turned over to the welders to do and do quickly. Since the break was just outside the tapered fit, it was obvious that it would not be possible to weld the broken piece in perfect alignment. In view of this it was decided to weld a new stub end on the rod. It was found that an old car axle 5½ in. in dia. was approximately the same quality of steel as the hammer rod. As the piece needed was 11 in. long a piece 11¼ in. was cut from the axle. The ends of the rod and the new piece were then scarfed, cleaned of all scale and oxide and placed on vee blocks for welding.

This torch weld was made alternating sides at short intervals. Only one operator was used as a precaution to keep the warpage to a minimum. The

Welded Repairs Saved Time and Money on this Railroad Shop Steam Hammer.

weld was completed in four hours taking all the care known to an expert welder. After the rod was cool the taper was machined on the new end leaving no trace of the weld. The hammer was reassembled and back in service with no harmful delay.

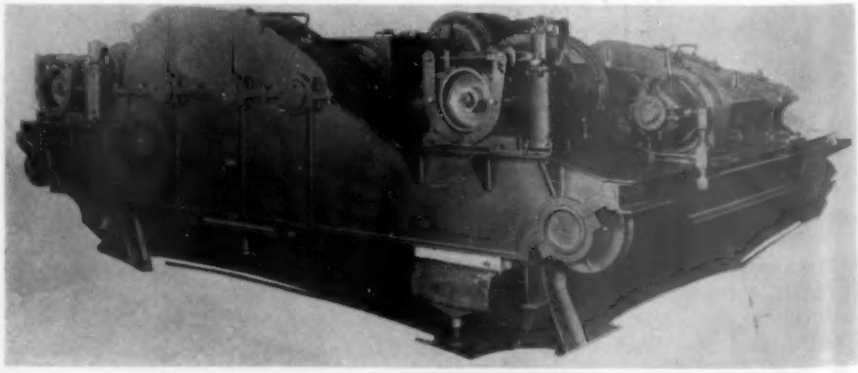
This happened many months ago long enough to prove to all concerned that the welding was a successful repair method under conditions that certainly made for a real test of welding.

» «

Welded Crane Trolley

A 45 ton crane trolley of welded construction built for the Nevada Consolidated Copper Co. by Shaw-Box Crane and Hoist Co. is shown in the accompanying picture. The trolley has a main hoist of 45 tons capacity and two auxiliary hoists, each of 20 tons capacity. The purpose of the two auxiliary hoists is to permit the tipping of the ladle, which the crane handles, from either side.

Welded construction of crane equipment provides important weight savings and increased strength.



An All-welded 45 ton Crane Trolley. (Photo Metal & Thermit, Inc.)

THE TECHNICAL SLANT

IMPROVE TIME IN THE PRESENT, FOR OPPORTUNITY IS PRECIOUS — SAADI

Aircraft Construction

AIRCRAFT MATERIALS AND PROCESSES. *By George F. Titterton, Published by Pitman Publishing Co., New York, 1940. Cloth, 5½x8½ in., 328 pages. Price, $3.50.*

All 328 pages of Aircraft Materials and Processes are packed with valuable information on the many and varied materials which are used in aircraft construction. Included is a comprehensive discussion of: Steel and its alloys; aircraft steels; corrosion resisting steels; nickel steels; copper; aluminum; magnesium; wood; glue; fabrics; dope and plastics, as well as data on processing these materials; such as, heat-treating, welding, joining. It is the first book that has come to this reviewer's attention that has comprehensively and completely covered the materials of the aircraft industry. By the nature of its coverage, in which needless details are omitted, it could be classed as a "handbook" of materials and processes for the aircraft worker whether he is an engineer, a factory employee or a student.

» «

Oxy-Acetylene Welding

INSTRUCTIONS IN OXY-ACETYLENE WELDING AND CUTTING PROCESS (LECTURES). *Published by Air Reduction Sales Co., New York, 1940. Cloth, 8½x11 in. 94 pages. Price $1.00.*

INSTRUCTIONS IN OXY-ACETYLENE WELDING AND CUTTING PROCESSES (WORK SHEETS). *Published by Air Reduction Sales Co., New York, 1940. Cloth 8½x11 in., 31 pages. Price 50 cents.*

INSTRUCTIONS IN AIRCRAFT WELDING—— OXY-ACETYLENE (EXERCISES). *Published by Air Reduction Sales Co., New York., 1940. Paper, 8½x11 in., 36 pages. Price 50 cents.*

These three books form the basis for a comprehensive course of classroom exercises and lectures covering the oxy-acetylene welding and cutting processes. The first two books alone cover a course in oxy-acetylene welding and cutting, one containing a complete set of work sheets, and the other lecture material to be used as a supplement to the first. The third book may be used as a supplement to the course for those wishing to become familiar with aircraft welding.

The book covering classroom exercises is intended to impress the fundamentals upon those who are interested in gaining a working knowledge of the art. Its 22 chapters describe the practice of both oxy-acetylene welding and cutting.

The course of lectures, although printed in a separate book, works in close conjunction with the student exercises. It describes the history of the art, the properties of its materials, its theories and its practical application in industry. The book has been prepared so as to broaden the horizon of the student of the oxy-acetylene process and to insure intelligent application of the manipulative skill he is attaining.

The purpose of the instruction book on aircraft welding is to provide that industry a well planned series of exercises (67) to illustrate all the varied conditions existing in the art of aircraft welding. It can be utilized also to train operators who have had previous experience in other lines of oxy-acetylene welding.

» «

Mathematics

PRACTICAL MATHEMATHICS *(Second Edition). By Glenn M. Hobbs and James McKinney. Revised by J. Ralph Dalzell. Published by American Technical Society, Chicago, 1940. Cloth, 5½x8½ in., 599 pages. Price, $2.40.*

Practical Mathematics, as the name implies, is truly practical. For this reason it is an excellent handbook for the student studying mathematics and for those who have forgotten and want to review.

The second edition has been largely rewritten and was then time tested by students in over a year's use in pamphlet form. It is devoted entirely to practical mathematics for those engaged in shop or related engineering work and covers all of the more common phases of mathematics. Special emphasis has been placed on those chapters dealing with factoring, cancellation, fractions, percentage, ratio and proportion.

There is also included a number of illustrative problems which have been supplemented with examination problems that have answers given. In addition to a 5 place logarithms table for numbers from 1 to 999, there are a number of tables of useful information covering weights, measures, etc.

» «

Metallurgy

WELDED METALLURGY. *By O. H. Henry and G. E. Claussen. Published by American Welding Society, New York, 1940. Simulated leather, 5x8 in., 357 pages. Price 50 cents.*

This is believed to be the first book on metallurgy written from the welding standpoint. The book, which is in two sections, contains a series of lectures presented by the authors before the New York section of the A.W.S. during the past two years.

The first ten chapters, which compose last year's lecture series, cover the fundamentals of metallurgy to familiarize the reader with the composition and structure of metals commonly used in welding. In the second section of the book there is shown the effect of varied conditions of heat and stress in welding and other information on the "after-effects" of welding.

The main theme of Welding Metallurgy is to illustrate how a knowledge of metallurgy can be used to control the welding processes. As such it should prove very helpful to the student interested in this new metallurgical angle.

» «

Selling

SALESMEN BUILT AMERICA. *By George A. Hughes. Published by the Dartnell Corp., Chicago, 1941. Laminated cloth, 6x9 in., 96 pages. Price $1.50.*

Salesmen Built America is a book of two parts, the first part consisting of a 14 page biography of a master salesmen, George A. Hughes, Chairman of the Board, Edison General Electric Appliance Co., Inc. The remainder of the book is made up of a series of 26 inspirational messages by this master salesman.

Mr. Hughes has written of various incidents, in some cases, they are based on his own experiences as a salesman, in other cases the subject is far removed from selling. Through his sales philosophy and logic, he works each subject around so that by comparison it will inspire the reader to greater heights and achievements.

Along with these inspirational thoughts dealing with selling problems, it is also pointed out how important the salesman has proved to be in the American plan of life.

» «

Welding

AUDEL'S WELDERS GUIDE. *By Frank D. Graham. Published by Theo. Audel & Co., New York, 1940. Flexible cloth, 5 x 6½ in., 432 pages. Price $1.00.*

The Welders Guide is a pocket size book of the question and answer type. It covers all kinds and types of welding and contains many questions and answers on the theory and practice of welding and the operation and maintenance of welding equipment.

This book contains much information of value but as is true of the question and answer type, it is difficult to obtain information on a specific subject. In a book containing several thousand questions with their answers it is impossible to index the book completely. So, the only way to obtain a specific answer is to read through a pertinent chapter until it is found. To assist the reader in this task, the book has been divided into 21 chapters covering the subjects welding methods, machines, applications, cutting, symbols and safety.

New Product Developments

Radiator like fins are said to keep these torch nozzles cool.

Something New in Welding Torches

★ **Victor Equipment Co.,** 844 Folsom St., San Francisco, now advise that they are ready to market an air-cooled welding torch nozzle called the **"Airadiator."** As the name suggests, it has a radiator-like section, made out of aluminum and provided with disc fins.

This radiating device is made out of aluminum and the company advises that even in severe field tests and on most difficult operations, no problems have arisen which prevented the maintenance of the desired flame characteristics.

The very large cooling area provided by the fins is claimed to keep this tubular section cooler than the ignition temperature of the fuel gas thus eliminating pre-ignition and the resulting backfiring. The torch handle is said to be kept comfortably cool, an additional advantage particularly in the small airplane types of welding torches.

All Victor welding torch types and sizes may now be equipped with nozzles of the "Airadiator" design. Additional information will gladly be furnished by the company to anyone interested.

» «

Improved Eyeshield

★ An improved eyeshield for use on gas welding, cutting and blow torch operations is announced by **Jackson Products,** Detroit, Mich. This new eyeshield, designated as **Type BX,** is a cover-all shield, the use of which does not interfere with the wearing of prescription glasses. Enlarged opaque fiber side pieces afford greater protection. The light, opaque frame fits snugly to forehead and cheeks, barring light and sparks.

The shield takes a standard 2 in. by 4⅛ in. lens, secured in the lens retaining frame by an improved spring. Connection between shield and the sturdy headgear provides better adjustment of lens angle with reference to the face. This type of eye protection is preferred on many types of work because of the wide range of vision afforded and the ease with which the entire lens assembly can be pushed up out of the way when not neded. Its lightness and non-fogging features are said to encourage workmen to use this shield.

This shield protects eyes and glasses, too.

» «

Smaller Weld-O-Tron

★ **Allis-Chalmers Mfg. Co.,** Milwaukee, Wis., originator of the 5 to 75 ampere **Weld-O-Tron** low current electronic arc welder for light gauge metals, has now added a Junior size to its line for a range of 5 to 40 amperes. It is especially designed for those plants already equipped with motor generator welders that handle currents as low as 35 to 40 amperes.

Like the larger Weld-O-Tron unit, this smaller size supplies currents as low as 5 amperes and uses electrodes as small as 1/32 in. and 3/64 in. in diameter. It consists essentially of a three tube polyphase mercury vapor rectifier circuit—thus eliminating all rotating parts, using the company's Actron type of rectifier tubes.

Readily accessible controls and terminals are located on the front panel. They are of the dead front type and consist of a simple two way switch for changing the polarity of the output terminals.

According to the company, the constant current characteristic of its larger unit has also been given to the Junior Weld-O-Tron—making the arc easy to start, easy to hold, and producing an optimum heat condition at the weld. The same characteristics are obtained from minimum to maximum current settings.

A 5 to 40 amp. range for this electronic welder.

» «

Solder Fluxes

★ The **American Chemical Process Co.,** 11-02 Jackson Ave., Long Island City, N. Y., announce their new **"Tru Flux" Soldering Syrup.** It is a soldering flux of a free flowing type that is claimed to be suitable for most metals. It is also claimed that this flux is: (1) Free from acid, (2) less corrosive and (3) will not discolor metals.

"Tru Flux" soldering syrup may be obtained in either full strength or diluted solutions.

» «

Carbon Arc Torch

★ **Albert & J. M. Anderson Mfg. Co.,** 289 A Street, Boston, Mass., announce a new **Carbon Arc Torch** for A. C. arc welders. Designed for localized heating and preheating as well as welding non-ferrous metals, such as aluminum, copper and bronze, this arc torch may also be used for soldering, brazing and hard-surfacing. No adaptors or sockets are necessary as the carbon grips can take carbons for ¼ in. to ½ in. diameter.

A new carbon arc torch.

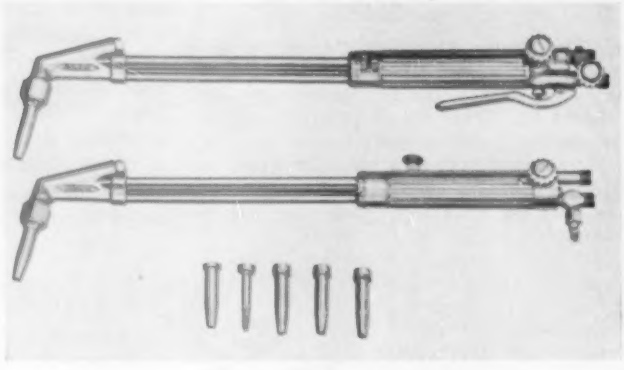
Intensity of heat is controlled by changing amperage while easy controls are provided for carbon adjustment within reach of thumb and forefinger. This torch is said to be well balanced, light in weight and has a comfortable grip.

New Product Developments

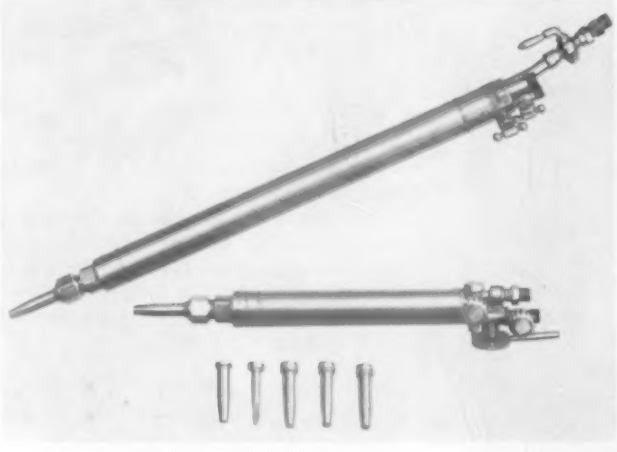
New Cutting Torches

The **Gasweld Equipment Co.,** 625 W. Jackson Blvd., Chicago, announce the addition of four new cutting torches to their manufactured line. Two, **Models No. 30-P** and **No. 301-P,** are manually operated cutting torches with button and lever type valve control, respectively. Aside from the difference in valve control, they are similar in construction and are designed for use with propane, Shellane, Philgas and all liquified gases.

The other two models are machine cutting torches, **No. 3000,** a 3 hose type enabling preheating and **No. 6000** is a smaller 2 hose straight line machine cutting torch. Both of these torches are for use with acetylene. **Models No. 3000-P** and **No. 6000-P** are torches of similar design for use with liquefied gases.



Models No. 301-P (upper) and No. 30-P (lower) cutting torches use liquified gases.



Model 3000 (upper) is a 3-hose torch. Model 6000 (lower) uses only 2-hoses. Both are for machine cutting.

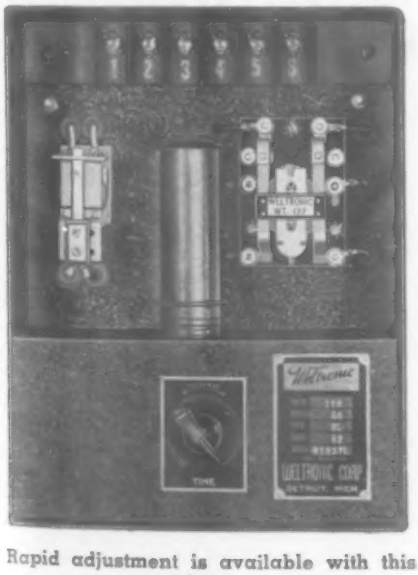
» «

Low Cost General Purpose Timer

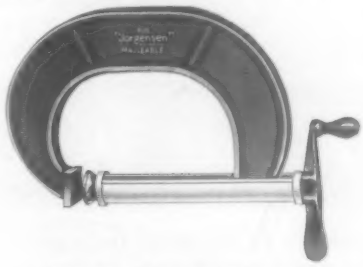
A new, low cost, general purpose timer, said to be capable of providing extremely accurate automatic timing control for virtually any requirement where cycling or sequencing must be controlled in seconds or fractions of seconds, is announced by **Weltronic Corp.,** 3098 East Outer Dr., Detroit, Mich.

The new timer **Model 52,** depends upon the electronic principle of timing which employs a vacuum tube as the essential timing element. Once set to the required time control, the electronic type timer never varies, it is said. A feature of this timer is the rapidity of adjustment afforded by the selector knob by which the operator may set the timer by merely "dialing" for the corect time. This can be done whether the front of the timer is open or closed.

While the range of timing operation can be specified as required for individual uses, this timer has an unusual wide range for its type, the limits being from 1/30th of a second to 120 seconds. The timer is available for 110 or 220 volts and for any commercial frequency. Mounted in a cabinet with hinged cover, the entire timer measures (with cover closed) approximately 8x4x10 inches.



Rapid adjustment is available with this timer.



The threads are protected.

Welder Clamp

★ The **Adjustable Clamp Co.,** 417 N. Ashland Ave., Chicago, are announcing a new line of **Jorgensen Shield Welder Clamps.** Featuring a shielded screw which provides positive protection against "spatter" from welding hitting and damaging the screw threads. It also protects the screw from heat, dirt, and grit, and from ordinary shop handling. The shield carries no part of the clamping load, and thus the holding qualities of the clamp are not affected even though the shield should become red-hot.

These shielded welder clamps are known as Style No. 8-S and are offered in two series: Series No. 800, a shallow throat model which opens to 12 in. and the No. 820 Series which has a deeper throat but opens to 8 in. only.

» «

Ignitron Tubes Redesigned

★ Recognizing that appearance as well as utility is of great importance to the user, the **General Electric Co.,** Schenectady, N. Y., has redesigned its **Ignitron Tubes** for resistance welder control. These tubes now have both inner and outer jackets of stainless steel and are completely corrosion resistant. They are available in ratings suitable for controlling nearly all sizes of resistance welding machines.

Stainless steel jackets improve appearance and performance.

New Product Developments

New Model Face Shield

★ The **Boyer Campbell Co.**, 6540 Antoine St., Detroit, Mich., announce a new **B & C Face Shield** known as the **Model 66.** This shield is fitted with a plastacele window gimp-bound to provide greater flexibility for adjustment to the face of the operator. The window buttons on with snap fasteners and is adaptable to all of the model B & C Face Shields with the exception of No. 10 and 20. The other features such as fully adjustable (patented) friction joints and interchangeable sweat bands which are common to all models of B & C face shields, are incorporated in this model, too. The window sizes are .020 x 4 x 9 and .020 x 4 x 6 inches.

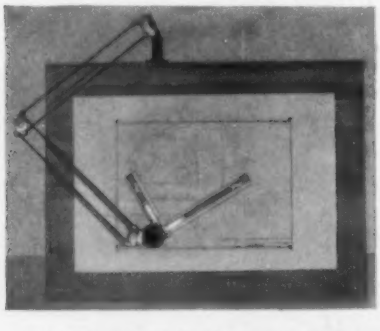
Snap fasteners keep this shield's window in place.

Drafting Machine

The **Drafto Co.**, 262 Walnut St., Cochranton, Pa., announces production of a new, low-priced drafting machine, designated as the **"Master-Drafto" Model No. 60,** which takes a maximum size sheet 24 x 36 inches.

Light in weight for ease of operation, the Master-Drafto is solidly built to stand hard use. The arms are constructed of seamless steel tubing, fitted with solid bearings. The scale blades are designed so that any scale, either boxwood or aluminum, can be inserted. The stainless steel protractor plate is graduated in 2 degrees, and can be set accurately for ½ degree readings by use of the graduated vernier.

The manufacturer will furnish illustrated literature and prices upon request.



A light weight drafting machine.

» «

Gas Regulator Bulletin

Alexander Milburn Co., 1410 W. Baltimore St., Baltimore, Md., has just issued a special portfolio describing the Milburn line of single and two stage ball seat type gas and air regulators.

» «

Cylinder Valving Machine

The **Model A-2 Universal Valving Machine** has been announced by **Independent Engineering Co.**, O'Fallon, Ill. Equipped with the latest features in torque gauging and cylinder vises, this machine is designed for inserting and removing valves from cylinders ranging in dia. from 2 to 16 in. and from 10 to 53 in. in height.

» «

Dial Gauge

The **George Scherr Co.** announces a new **GS Dial Test Indicator** with simplified lever movement. Instead of the usual rotating multiple gear and pinion trains, the GS indicator utilizes a lever arm and is constructed on the principle that the simpler the mechanism the greater will be the accuracy and durability of the tool. The dial is graduated in 1/1000 in. with a plunger travel of 3/16 in.

Full information may be obtained from the George Scherr Co., 128 Lafayette St., New York, N. Y.

» «

Deep Throated Toggle Pliers

A new rapid action **Toggle Pliers** with a 1½ x 3 in. throat capacity, identified as **Model No. 450,** are announced by Knu-Vise, Inc., 16841 Hamilton, Detroit. They are made from a 10 and 20 S.A.E. forging, hardened and tempered.

Toggle Pliers are manually applied by simply squeezing the handles—automatically locking in position and holding positively, but releasing instantly when desired, having a claimed pressure ratio of 93 to 1.

Positive grip with these pliers.

The Knu-Vise line comprises 52 models of clamps and pliers adjustable for use as "C"-Clamps for holding materials in close contact or in position for welding, reaming, drilling and assembling.

News of the Industry

Urgency of National Defense Causes Cancellation of Annual I.A.A. Meeting

The Directors and Officers of the International Acetylene Association have decided to defer the 1941 Convention scheduled to be held in Cincinnati April 2, 3, and 4. The decision to postpone the Convention was made because of the growing feeling that technical and other manpower, normally applied to Convention activities, should be released for work of more urgent nature. By this action, the Directors and Officers of the Association felt that the Association could best contribute to our National Defense Program by leaving its members free to devote their undivided attention to the most urgent of today's great national and industrial problems.

Federal Government Again Recruits Engineering Draftsmen

Engineering draftsmen in various optional fields are urgently needed by the United States Government. A civil service examination held last fall failed to produce enough eligibles to meet the demand of the national defense program. The United States Civil Service Commission has, therefore, reannounced the examination and will accept applications until December 31, 1941. The salaries of the positions range from $1,620 to $2,600 a year less a 3½ percent retirement deduction.

Further information and application forms may be obtained from the Secretary of the Board of U. S. Civil Service Examiners at any first- or second-class post office, or from the U. S. Civil Service Commission, Washington, D. C.

Chemical Engineers Needed For National Defense Work

There are various grades of chemical engineer positions open, with salaries ranging from $2,600 to $5,600 a year, less the retirement deduction of 3½ percent. Engineers with experience in strategic mineral research are especially needed by the Bureau of Mines, Department of the Interior. The Regional Research Laboratories of the Department of Agriculture need persons experienced in the industrial utilization of surplus agricultural products. Separate employment lists will be established for positions in various specialized branches of chemical engineering such as fuels, foods, petroleum production, and plastics.

Further information and application forms may be obtained from the Secretary of the Board of U. S. Civil Service Examiners at any first- or second-class post office, or from the U. S. Civil Service Commission, Washington, D. C.

» «

7th Welding Confab

"Heinie" Schneiderwind announces that the **Omaha Welding Co.'s Seventh Annual Welding Confab** will be held March 4, 5, 6 and 7. Over twenty companies associated with the welding industry are cooperating to make this Confab the most successful of those sponsored by the Omaha Welding Company.

Advance requests for tickets indicate that last years' registration of 608 will be exceeded. Requests for tickets by those interested in attending this Confab should be addressed to 1501 Jackson St., Omaha.

» «

Machine Tool Show

The **National Machine and Tool Progress Exhibition,** under the sponsorship of the **American Society of Tool Engineers,** will be held March 25 to 29 inclusive, at Convention Hall, Detroit. The major theme of the Exhibition and the concurrent annual convention of the A. S. T. E. is "education for National Defense."

» «

Iowa State Welding Conference

The **13th Annual Welding Conference** at Iowa State College, Ames, Iowa, has been scheduled for March 19 to 21, 1941, according to an announcement by **D. C. Farber,** Director of Engineering Extension Service.

» «

Mining Engineers Meet

The **American Institute of Mining Engineers** will hold their **154th Meeting** at the Engineering Societies Building, 25-33 W. 39th St., New York, Feb. 17-20. The annual awards of the Institute will be presented during the meeting along with more than 150 papers on all phases of mining engineering.

Arcos Corp., Philadelphia, Pa., announces an addition to its stainless electrode manufacturing plant which will give it approximately 100% increase in capacity. The new units have been in partial operation since mid-January and will be completed by mid-February. Delivery schedules will be stepped up as the result of this expansion.

» «

A. S. T. M. Meeting

Two technical symposiums, one on Color—Its Specification and Use in Evaluating the Appearance of Materials, and the second on New Methods for Particle Size Determinations in the Subsieve Range will feature three sessions of the **Spring Meeting of the American Society for Testing Materials** to be held at The Mayflower, Washington, D. C., on Tuesday and Wednesday, March 4 and 5.

Throughout this week beginning March 3 and extending through the 7th, there will be some 200 meetings of the Society's committees, participating in what is known as Committee Week. Indications point to more committee meetings during this period than in any other year.

For sound OVERHEAD welds use

TITAN MANGANESE BRONZE

TITAN Manganese Bronze Welding Rods flow freely, readily penetrate seams and crevices and provide extremely dense, non-porous welds. Overhead welds made with TITAN Manganese Bronze will "stay put."

TITAN Manganese Bronze is widely used because of its ability to lay down strong, tough welds in any position. There is no fuming to bother the operator or cause poor welds, because the exclusive TITAN Double Deoxidation process prevents gases from being absorbed from torch, atmosphere or base metal.

Another TITAN Doubly-Deoxidized Alloy preferred by experienced welders is **Penn Bronze**—a general purpose, free-flowing rod, melting at 1620° F.

Samples of TITAN Doubly-Deoxidized Welding Alloys gladly sent on request. Test them; prove that they produce welds of definitely greater strength and ductility.

TITAN METAL MANUFACTURING CO., BELLEFONTE, PA.

TITAN BRONZE WELDING ALLOYS

The firm of **H. O. Bates,** 251-257 N. Broad St., Elizabeth, N. J., manufacturers of marking devices and consultants on marking problems, has been incorporated as **The Acromark Corp.**

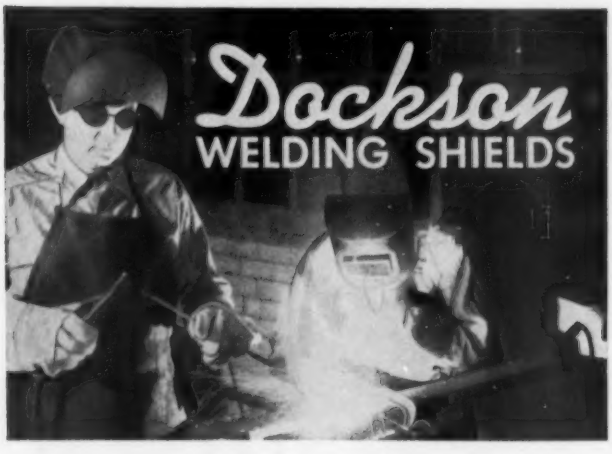
The officers of the Corporation are as follows: H. O. Bates, President; J. L. Golomb, Vice-President; A. D. Bates, Treasurer, and Mr. S. R. Rosenberg, Secretary.

Welding Exhibit for New Jersey

The American Welding Society, **Northern New Jersey Section,** is sponsoring an industrial exhibit featuring welding equipment, supplies and applications will be held in the Mosque Building, 1020 Broad St., Newark, N. J., on **March 21-22, 1941.** The purpose of this exhibit is to give welding executives and welding operators of the New Jersey industrial area an opportunity to review and to investigate the latest developments in welding materials in the most convenient manner. The time of the exhibit has purposely been limited to the last two days of the week so that plant men may have an opportunity to visit it without loss of work time and also so that manufacturers' representatives may be in attendance at their booths without undue loss of travel time in their districts.

The basement floor of the Mosque Theater provides for forty-five booth spaces of varying dimensions, over half of which were reserved before formal announcements had been prepared. Chairman of the Exhibit Committee is **W. H. Hart,** Secretary, Charles W. Krieg Co., 52 Dickerson St., Newark, N. J.

» «



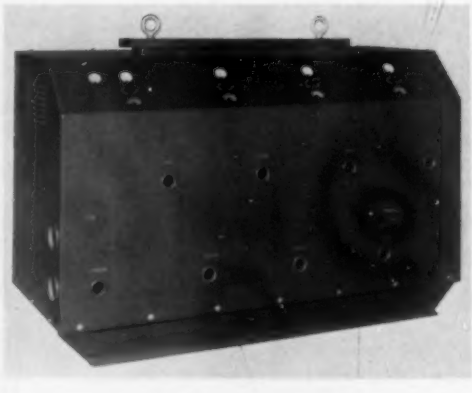
WELDING AND CUTTING TORCHES
REGULATORS
ELECTRODE HOLDERS
HELMETS - GOGGLES
ACCESSORIES
FACE SHIELDS

A CORRECT SHIELD FOR EVERY WELDING HAZARD IN A COMPLETE PRICE RANGE

SEE YOUR JOBBER OR WRITE

DOCKSON Corporation
WELDING & SAFETY EQUIPMENT
3867 WABASH AVE. • DETROIT

SHIFT YOUR JOB INTO *High*



You can keep pace with stepped-up production schedules yet keep your welding costs down . . . it's easy with the new Glenn-Roberts Model 85 on the job! Look over these features:

1. Single or multi-circuit operation for manual or automatic-head welding.

2. Wide-range output; four welding circuits of 90-625 amperes each —may be "ganged" in any combination for higher output, up to 2000 amperes for single-circuit work.

3. Independent full-range current control for each circuit or combination, plus cost-cutting remote control; self-contained switches and contactors for automatic welding.

GET THE JOB-TESTED *FACTS* ABOUT MODERN GLENN-ROBERTS WELDERS — WRITE TODAY FOR FREE LITERATURE.

GLENN • ROBERTS COMPANY, INC.
1009 FRUITVALE AVENUE • OAKLAND, CALIFORNIA, U. S. A.

Personals

D. R. Watson Joins The Welding Engineer

D. R. Watson, who for many years was the Atlanta advertising representative for McGraw-Hill, has joined the advertising staff of *The Welding Engineer.* He will be associated with *The Welding Engineer* as Mid-west advertising representative.

Mr. Watson has been active many years in business publication work. The experience gained in working with industrial marketing problems fits him to consult ably with advertisers in *The Welding Engineer* to make their advertising programs increasingly effective.

» «

Election of four executives to the rank of Vice President is announced by **A. W. Robertson,** Chairman of the Board, **Westinghouse Electric & Manufacturing Co.** They are **Bonnell W. Clark** of New York, now President of the Westinghouse Electric Supply Company, a subsidiary; **R. A. McCarty** of Philadelphia, Manager of the Steam Division; **Frank D. Newbury** of Pittsburgh, Manager of the Emergency Products Division; and **A. C. Streamer,** of Pittsburgh, General Manager of the East Pittsburgh Division. All the new vice presidents have been identified with Westinghouse for many years.

» «

George N. Jeppson has been elected president of the **Norton Co.,** Worcester, Mass., to succeed **Aldus C. Higgins,** who recently resigned to become chairman of the board, a position vacant since the death of Charles L. Allen last November 4. Mr. Jeppson has been associated with the Norton Co. since 1892 and before becoming president, was vice-president and treasurer.

Mr. Higgins, the new chairman of the board of directors, joined the Norton Co. in 1900. He managed the abrasive plants before he was elected secretary in 1912 and treasurer and general counsel in 1919. He had been president of the Norton Co. since 1933.

It is announced that **G. Donald Spackman** has been appointed General Manager of **Lukens Steel Co.** and its subsidiaries. In the summer of 1919, Mr. Spackman joined the Mechanical Dept. Lukens Steel Co., handling steam, hydraulic and combustion problems. Later he was appointed Fuel Engineer for the Company serving in that capacity until August 1925 when he was appointed Superintendent of the Flanging Dept.

In Aug. 1929, he became Assistant General Superintendent of Lukens Steel Co. When the Lukenweld division was formed in May 1930, Mr. Spackman was elected its President. In Sept. 1936 he was appointed General Superintendent of Lukens Steel Co.

» «

In connection with its national defense production, the **Westinghouse Electric & Mfg. Co.** which will operate two government ordnance plants, one to be built at Louisville, Kentucky, the other at Canton, Ohio, announces the following appointments.

James R. Weaver has been appointed manager of the Louisville plant. Mr. Weaver was up until his appointment, Director of Equipment, Inspection and Test for Westinghouse. He has been with the Company since 1915 when he started in as a tool designer.

R. V. Gavert has been named manager of the Canton, Ohio plant. Mr. Gavert came to Westinghouse in 1914 as a machinist apprentice. His career has been in the line of supervisory work, first at East Pittsburgh, then at Chicopee Falls, and most recently at Sharon. There he served from 1936 up to his present appointment, as Superintendent and Manager of Manufacturing.

» «

The **Sight Feed Generator Co.**, Richmond, Ind., announce the opening of a new warehouse at 311 E. 23rd St., Chicago. This warehouse branch, under the supervision of **Marshall Beymer**, will

Marshall Beymer, mechanical and electrical engineer, is in charge of Sight Feed Chicago branch.

carry a complete stock of Sight Feed A.C. Welders and Acetylene Generators as well as furnish engineering service on these products.

» «

Edward D. Gangwere has been appointed director of equipment according to a recent anouncement of the **Westinghouse Electric & Mfg. Co.** He first joined Westinghouse in 1903 as a milling machine hand at East Pittsburgh. Later he became a demonstrator machinist, then a foreman and general foreman. He was promoted to supervisor of equipment and methods in 1922 and to chief inspector in 1931. Since 1937 he has been in the works equipment, inspection, and test department.

» «

John C. Chaffe has been appointed District Manager of the Philadelphia office of **Tube-Turns, Inc.**, Louisville, Ky., manufacturers of welded pipe fittings. Mr. Chaffe's office will cover a surrounding area that extends through Wilmington, Baltimore, and Washington, D. C. The Tube-Turns Philadelphia office was simultaneously moved from the Lafayette Building to the Broad Street Station Building.

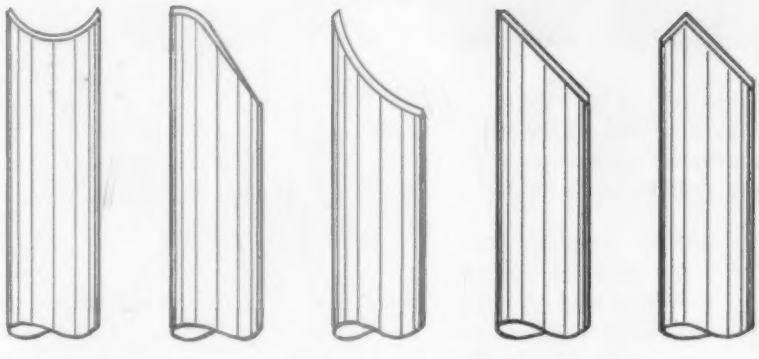
» «

Tom H. Pike, Jr., West Coast district manager for **Tube-Turns, Inc.**, Louisville, Ky., has established permanent offices in Los Angeles, at 210 West Seventh Street. The entire west coast and territory inland as far as Salt Lake City will be serviced from the new Los Angeles office.

A NEW

PIPE WELDING

SERVICE



We furnish pipe cut to measure, accurately fitted and bevelled, ready for welding by the customer without further preparation.

All cuts are made with our exclusive cutting machines, clean and smooth, free from oxide and slag, perfectly fitted, easy to weld.

Single pieces or complete assemblies are furnished in all pipe sizes of any wall thickness, with ends prepared to fit any intersection at any angle.

Illustrated circular will be sent on request.

If it can be made of welded pipe, we can make it.

CHICAGO PIPE WELDING CO.

1715 - 205 W. WACKER DRIVE **CHICAGO**

Two staff changes, designed to improve its engineering services, have been made by the **American Institute of Steel Construction,** effective January first.

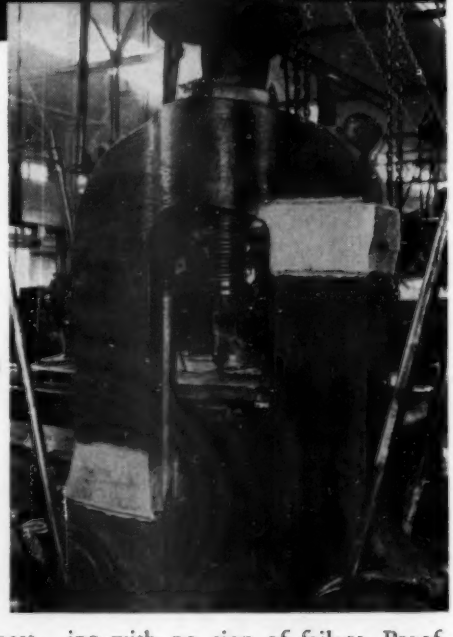
F. H. Frankland, Chief Engineer and Technical Director, has been made Director of Engineering and will devote his entire time to technical research related to the design and use of structural steel and to other matters of engineering economics with which the Institute is concerned

T. R. Higgins, who has been in charge of the Institute's New York Metropolitan Office for the past year, will become Chief Engineer and will supervise and manage the operations of the Institute's District Offices now located at Worcester, Mass.; Philadelphia, Pa.; New Orleans, La.; Atlanta, Ga.; St. Louis, Mo.; San Francisco, Cal.; Cleveland, Ohio; Chicago, Ill., and Topeka, Kansas.

» «

The **Okonite Co.** announces the opening of the sixteenth district office at 1212 Comer Building, Birmingham, Ala. Appointed manager of this new office is **Dewey A. White,** formerly sales engineer in the Company's Atlanta Office. Mr. White, who has been connected with Okonite for seventeen years, will have included in his South Central Territory the States of Tennessee, Alabama, Mississippi and Louisiana.

How strong is a 400 lb. Tobin Bronze weld? How quickly can it be made?



The story of the repair welding of this 15-ton roll housing reveals the answers to these important questions..

IN MARCH, 1939, this huge housing on a 33" rolling mill cracked resoundingly and thundered to the floor. To save time, two temporary repair-welds with Tobin Bronze were tried. Welders, working steadily in two shifts, used 400 lbs. of Tobin Bronze ⅜" rod for each weld; needed only nine days to finish the job.

Today, 23 months later, this mill is still rolling metal —24 hours per day, 6 days per week. *What's more,* during the past year, the housing has been subject to more strain than ever before; in fact, since the welds were made, four rolls have broken in the frame—yet the heavy stresses have been absorbed by this "temporarily" welded housing with no sign of failure. Proof positive of the strength of good "Tobin" welds in cast iron!

Tobin Bronze welding rods are stocked by all leading supply houses.

Only the genuine is trade-marked "Tobin Bronze —Reg. U. S Pat. Off." 41132

ANACONDA *Anaconda Welding Rods*

THE AMERICAN BRASS CO., General Offices, Waterbury, Conn.
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.
Subsidiary of Anaconda Copper Mining Co.

Current Reviews

New High Nickel Alloy Bulletin

Technical Bulletin T-19 **"The Deep Drawing, Shearing and Perforating of Monel, Nickel and Inconel"** is the newest addition to the **International Nickel Co.'s.,** 67 Wall St., New York, series of technical bulletins and covers the shearing and perforating of high nickel alloys. In addition to comparative mechanical characteristics of deep drawing materials, this 12-page pamphlet contains information on die materials, lubricants, drawing, annealing and pickling practices.

» «

Cable Connector Bulletin

Tweco Products Co., English at Ida, Wichita, Kan., have recently issued a new **Bulletin 1941-G** which describes and illustrates their entire line of cable connections. In addition to complete descriptions of their line of ground clamps, electrode holders and cable connectors and lugs, prices are also given.

» «

Hoist and Crane Catalog

A revised edition of their general catalog covering hand-operated hoisting equipment, trolleys, and cranes has been announced by the **Wright Manufacturing Division** of the American Chain and Cable Co., Inc., York, Pennsylvania. It is known as **Wright 12-C Catalog.** Additions to the line include a floor type Gantry Crane, a Portable Floor Crane, and a new Winch.

Complete data is included on spur-geared, screw-geared and differential hoist as well as considerable engineering data on cranes, trolleys, and winches.

» «

New Lathe Catalog

The **South Bend Lathe Works,** South Bend, Ind., has just issued a new general **Catalog 100A** which is said to be one of the most complete lathe catalogs ever published. The catalog has 112 pages and contains over 240 illustrations. It

shows 50 different sizes and types of South Bend Back-Geared, Screw Cutting Lathes for manufacturing, tool room and general shop work. A copy will be mailed on request to any firm or individual mentioning this magazine.

(Continued page 47)

Welded Connections for Multi-Story Buildings

The American Institute of Steel Construction's tentative standards for welded connections permits use of heavily-coated electrodes only. Unit stresses in welds shall not exceed those permitted, for welds made with heavily-coated electrodes, by the A. W. S. Code for "Fusion Welding in Building Construction." The other requirements of that code shall be complied with as a minimum. Special care is necessary when welding at temperatures below 25 deg. F.

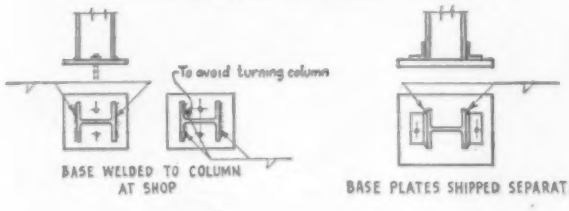
The size of fillet welds should be selected with regard to inherent efficiency of small welds, necessity of making connections in small space limitations of welding technique. Practical evaluation of these factors has established the ¼ in. and the 5/16 in. fillet welds as standard sizes for structural welding. The designer should determine whether connections are to be rigid or flexible and indicate this on design drawings, preferably by sketches.

Except as otherwise indicated by designer, all connections shall be designed as flexible. Flexible beam connections shall permit ends of beam to rotate sufficiently to accommodate its deflection by providing for a horizontal displacement of top flange as determined by following formula:

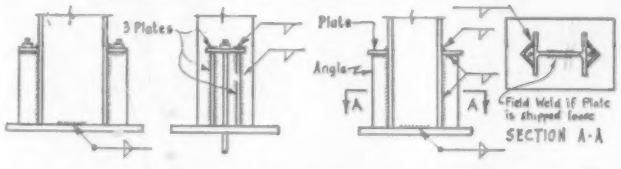
$$e = \frac{S \times L}{3{,}625{,}000}$$

where e = horizontal displacement between top and bottom of beam at its end (in.).
S = flexural unit stress in beam at mid-span (psi.).
L = span of beam (ft.).

TYPICAL DETAILS OF COLUMN BASES

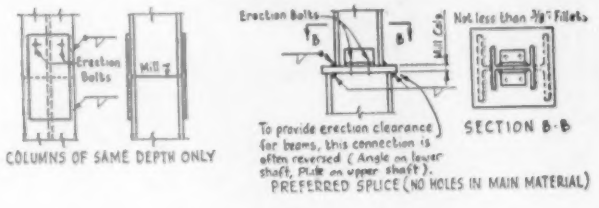


TYPICAL DETAILS OF CRANE COLUMN BASES

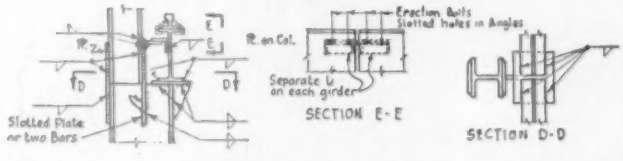


Typical details of column bases, including crane column bases.

TYPICAL DETAILS OF COLUMN SPLICES

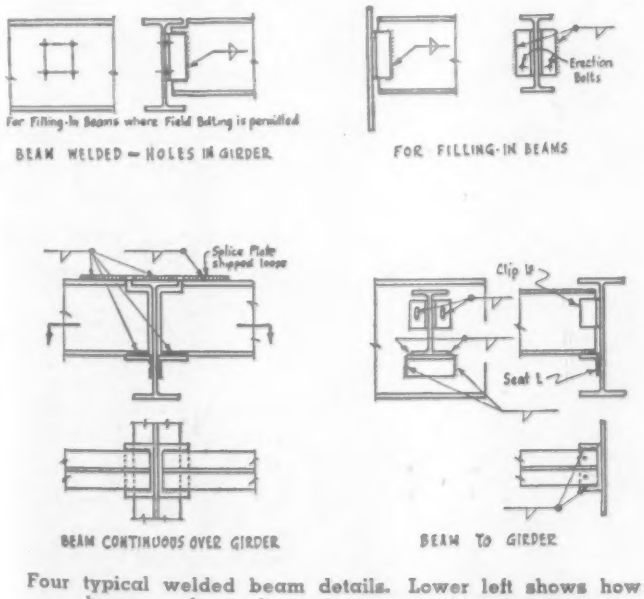

Erection Bolts
Mill
COLUMNS OF SAME DEPTH ONLY
Erection Bolts
Not less than 5/16" Fillets
To provide erection clearance for beams, this connection is often reversed (Angle on lower shaft, Plate on upper shaft).
SECTION B-B
PREFERRED SPLICE (NO HOLES IN MAIN MATERIAL)

TYPICAL DETAILS OF CRANE COLUMN SPLICES



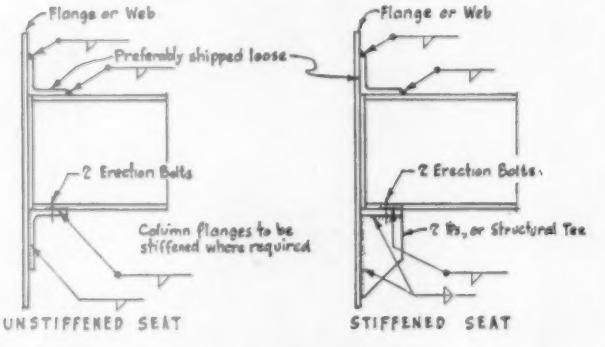
Typical details of column splices, for columns of same depth (left) and for columns of dissimilar depth (right). Also crane column splice (lower left).

TYPICAL BEAM DETAILS

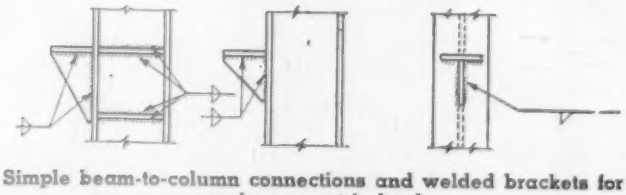


Four typical welded beam details. Lower left shows how beam can be made continuous over top of girder.

SIMPLE BEAM TO COLUMN CONNECTIONS



2-PLATE OR TEE BRACKETS CARRYING ECCENTRIC LOADS

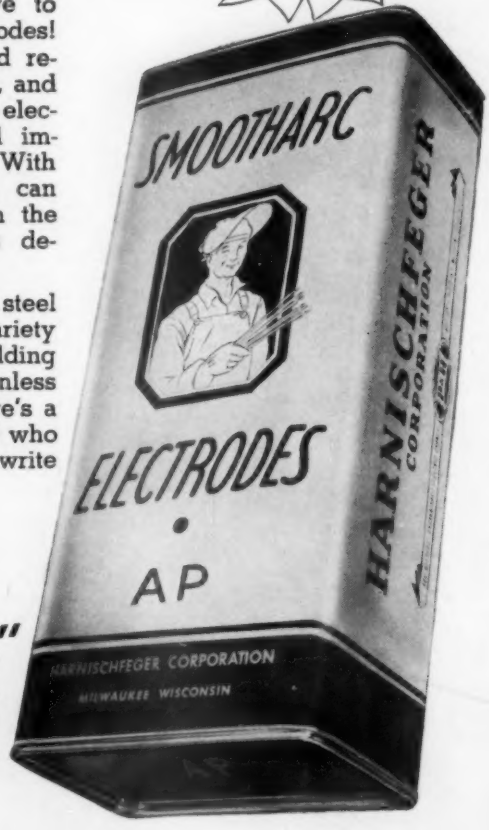


Simple beam-to-column connections and welded brackets for carrying eccentric loads.

AT A TIME LIKE THIS:

— when production calls for speed . . . you don't have to stop to test welding electrodes! Assure yourself of proved results, speed up your work, and cut your costs with P&H electrodes — approved by all important testing bodies. With simple procedures, you can quickly and easily obtain the exact physical properties desired in your welds.

Besides all standard mild steel types, P&H offers a wide variety of coated electrodes for welding high and low alloys, stainless steel, tool steels, etc. There's a P&H representative nearby who will gladly advise you. Or write us for information.



KEPT "Oven Dry" IN AIR-TIGHT CONTAINERS

P&H WELDING ELECTRODES

Ask about the new P&H-Hansen Square-Frame Welders. With simple, parallel hook-up they meet all high and low amperage needs. Bulletin W-28.

General Offices: 4513 W. National Avenue, Milwaukee, Wisconsin

HARNISCHFEGER CORPORATION

WELDING ELECTRODES • MOTORS • HOISTS P&H ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

Obituary

Fred W. Clifford—founder of the company now operating under the name Victor Equipment Company and one of the early pioneers of the welding industry, passed away at his home, in San Francisco, Calif. on Dec. 30.

Fred Clifford was born in Concord, N. H., in 1866. He was the founder and owner of the first American electrolytic oxygen plant which he built at Niagara Falls, N. Y.

Fred W. Clifford

Moving to California some thirty odd years ago, he founded in San Francisco in 1910 — the Great Western Welding & Cutting Co. This company became the largest welding shop of its kind on the West Coast and originated the now well known line of Victor welding and cutting apparatus. As the demand for these equipments grew the company's name was changed to Victor Oxy-Acetylene Equipment Company — and all efforts were directed towards the production and sale of this apparatus. Increasing demand made the company's original plant inadequate so a larger one was built in the same block on Folsom Street. In 1928 the company's name was again changed to Victor Welding Equipment Company and a year later upon further expansion the present name of Victor Equipment Company was adopted.

C. W. Clifford was Secretary-Treasurer of these companies until his retirement the latter part of 1928.

With unbounded enthusiasm he foresaw the potential growth of the welding industry and even though his early efforts both in the East and on the West Coast were fraught with the constant hazards and repeated disappointments inherent in pioneering days his undaunted confidence and his irrepressible courage and enthusiasm carried him over every hurdle.

He was a member of Doric Lodge 216 F. & A. M. and San Francisco Scottish Rite Body — also a member of the Islam Temple Shrine. He also was a member of the San Francisco Commercial Club.

CURRENT REVIEWS

(Continued from page 44)

Clamp Catalog

The **Adjustable Clamp Co.**, 417 N. Ashland Ave., Chicago, Ill., has just issued a new catalog. Known as **Catalog No. 15**, this 32 page book covers the complete line of "Jorgensen," "Pony" and "Mark" brands of clamps, lathe dogs and similar equipment that is manufactured by the Adjustable Clamp Co.

» «

Milling Cutter Grinding Manual

A complete shop manual on grinding practice in connection with cemented carbide type face mills and end-cutting tools has been completed by **Carboloy Co., Inc.**, Detroit, and is available for distribution.

The booklet **(Carboloy Bulletin No. GT-127)** comprises some 20 pages, and is accompanied by two 21 in. by 15½ in. charts illustrating the complete grinding procedure. It covers practically every variable involved, from selection of grinding wheel type, shape, and speed, to recommended tooth profiles for different purposes and different forms of milling cutters and end-cutting tools. The manual takes into account the various types of tool grinders on the market, illustrating the method to be pursued on each type to obtain the best performance with the various cutters.

» «

Arc Welding for Building Construction

The 16-page bulletin recently published by **Air Reduction**, New York will be of interest to structural steel men, both from a design and construction standpoint. In it there will be found an interesting review of how welding decreases the weight and cost of structural steel . . . how it saves material in structural connections . . . provides greater freedom in architectural and structural design . . . eliminates cost of punching and drilling holes, reduces handling of heavy pieces in the shop . . . eliminates noise which is disagreeable to occupants of nearby buildings and confusing to workers in shop and field . . . facilitates remodeling and making offices with minimum removal of existing walls and floors . . . reduces corrosion and cost of painting and maintenance of exposed steel.

These various advantages of welding are illustrated specifically in a four page magazine article reprint featuring the construction of the Airlines Terminals Building in New York City. Designers will be particularly interested in two pages of fundamentals of design for welded construction. This section will aid in application to specific jobs on hand. Copies of this bulletin may be obtained from Air Reduction, 60 East 42nd Street, New York.

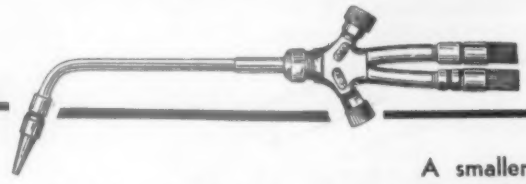
Gear Catalog

The **Atlantic Gear Works** has issued its new **1941 general catalog** on stock gears, sprockets and chains, reducers, bearings and couplings. A special supplement has been attached to the catalog listing the types of equipment that the Atlantic Gear Works now has available for special work. Large plants seeking subcontractors will be especially interested in this feature. Copy may be obtained by addressing Atlantic Gear Works, 204 Lafayette St., New York.

» «

Ladder Catalog

A new 44 page catalog, describing many types of aluminum ladders, has just been issued by the **Aluminum Ladder Co.**, 369 Adams St., Tarentum, Pa. In addition to the usual broad selection of ladders for fire fighting, industrial and commercial use, the new catalog includes



● *Dependable, lightweight*

GAS-SAVING TORCH

MILBURN TYPE LM JUNIOR

ADVANTAGEOUS PRICES

The ALEXANDER MILBURN Company

A smaller replica of renowned Milburn LM-B aircraft torch, with standardized and interchangeable tips and parts.

Especially useful in battery repair work and light welding, brazing and soldering.

Also complete welding and cutting outfits, interchangeable tips and latest improved regulators.

1403 W. BALTIMORE ST.
BALTIMORE, MARYLAND

The Improved "Round File" Gas Lighter

Locking "Slip-on" Renewal

—an exclusive feature

The patented cartridge holding the spark metal locks exactly in correct position, permitting instant replacement.

Get acquainted with the many other superior, exclusive features of Improved "Round File." *Circulars and prices on request.*

SAFETY GAS LIGHTER CO. (Est. 1901) **LYNN, MASS.**

data on aluminum gangways, stages, scaffolding, conveyors and many special aluminum ladders.

Some of the special ladders outlined are a portable entrance ladder which weighs only one-half lb. per foot of length, a channel ladder which is hinged in the middle, for easy storage, and a telescoping ladder made up of short lengths which can be easily connected to form one complete unit up to 26 ft. long.

The catalog also contains interesting general information relative to the strength, durability and utility of aluminum ladders and gangways. A free copy will be mailed to anyone requesting it on his business stationery.

» «

Pneumatic Tool Catalog

★ Eight new pneumatic tools are featured in the **THOR No. 52 Pneumatic Tool Catalog,** 1941 edition, now ready for distribution, announces the **Independent Pneumatic Tool Co.,** 600 W. Jackson Blvd., Chicago, Illinois. These new THOR tools consist of:- right angle and close corner drills, right angle nut setters and screw drivers, bolt wrenches, grinders, chipping hammers, sanders and saws.

The new catalog is fully illustrated by tool and action pictures and gives complete specifications on the entire line of THOR pneumatic tools and accessories, including:- Rotary and piston air drills; close corner drills; wood boring machines; wrenches and heavy tube rollers; rotary brushes; grinders; nut setters; screw drivers and tappers; core and rivet busters; chipping, riveting, scaling and staybolt hammers; balancers; motor hoists; holders-on; bench and floor rammers; rivet sets; rivet squeezers; sanders and saws; grinding, sanding, riveting and other accessories. This catalog is available upon request to the above company.

» «

Recent Patents

Welding Apparatus

2,227,194. **Bolton C. Moise,** Pittsburgh, and **Henry E. Passmore, Jr.,** Mount Lebanon, Pa., assigned to **National Tube Co.,** N. J. Filed Feb. 16, 1939. Issued Dec. 31, 1940. An apparatus is shown which appears to be related to the method described in the previous patent digest, No. 2,227,193. The machine is used to weld upright cylindrical sections, such as oil well casings, in end-to-end relationship. The two sections whose ends are to be joined are held in work supports. A flux retainer unit is placed at the joint. A carriage having a welding unit mounted thereon moves peripherally around the work and at the same time weld wire is fed forward to supply the requisite amount of weld metal. A feed for supplying powdered, granular or other flux by gravity in advance of the weld rod is mounted over the flux retainer.

» «

Treating Weld Rods

2,226,043. **Ralph J. Weaver,** Cuyahoga Falls, Ohio, assigned to **The Babcock & Wilcox Co.,** Newark, N. J. Filed Nov. 3, 1936. Issued Dec. 24, 1940. This invention utilizes a coating flux material of such consistency and adhesive qualities as permit its application to metallic rods in a plastic condition by an extrusion process. The coating has interruptions at particular locations on the rod to facilitate making electrical contact with the rod metal. The rods may be circular or non-circular and of irregular contour. The process involves moving the weld rod longitudinally through and in contact with a mass of plastic adherent coating material while intermittently shielding portions of the rod from contact with the coating substance. The invention covers not only the process but the apparatus as well. The device includes a number of extrusion dies through which the weld rod passes. The plastic coating is forced between the dies for contact with the rod. A unit for temporarily closing the space between the dies serves to interrupt the coating process at predetermined intervals.

» «

Welding Electrode

2,226,080. **Ralph H. Starrett,** Manhattan, Ill. Filed July 19, 1938. Issued Dec. 24, 1940. The object of this invention is the provision of a welding electrode which will deposit a large amount of weld metal during a welding operation so that a higher amperage welding current may be used without danger of overheating or burning the weld metal. The electrode has a trailer rod which is attached to the weld rod but is insulated therefrom by a suitable layer of flux. The trailer rod is attached along the length of the weld rod by means of the flux or a binding cord. The trailer rod is effective for keeping the molten metal at the welding point at a somewhat lower temperature but which will not affect the penetration of heat into the base metal directly beneath the welding arc. By the use of a pair of trailer rods instead of a single rod a greater amount of heat can be absorbed during the welding operation. The trailer rods attached to the weld rods terminate short of the lower end of the weld rods for permitting the formation of a puddle of molten metal prior to engagement by the heat absorbing trailer rods.

» «

Welding Conveyor

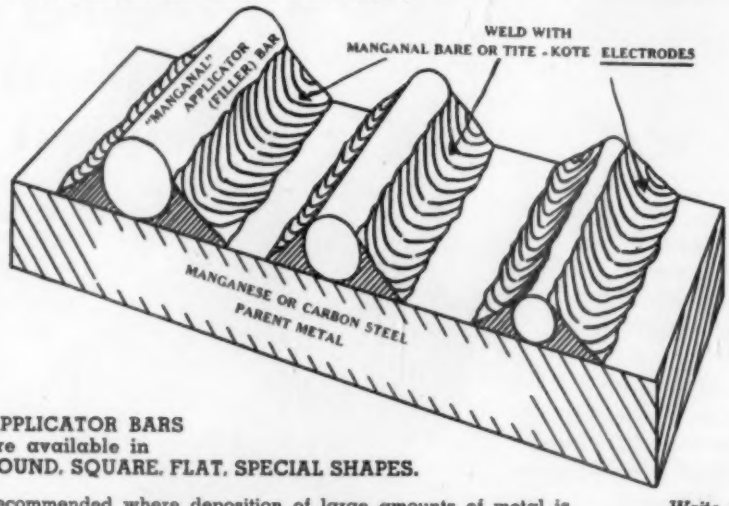
2,227,145. **Joseph R. Lex** and **Rudolph R. Heupel,** Detroit, Mich., assigned to **General Motors Corp.,** Detroit, Mich. Filed July 18, 1938. Issued Dec. 31, 1940. This patent relates to a shuffle or intermittent work conveyor and gang spot welder. The apparatus includes a continuously moving conveyor, a work carriage which moves on the conveyor, a station where welding is carried out and releasing elements operating in connection with the carriage and the conveyor for holding the carriage at the station while the welding operation takes place. In addition to the welding station, there may be other stations at which the work can be stopped for other necessary operations. A holding unit for maintaining the work in a steady position when left at a station is also included. With the device described in the patent, the inventors state that the rate of welding can go forward at 400-600 spots a minute.

REGISTERED U. S. PATENT OFFICE

MANGANAL

11 to 13½% Manganese Nickel Steel **APPLICATOR BARS**

U. S. Patents 1,876,738, 1,947,167 and 2,021,945)


WELD WITH
MANGANAL BARE OR TITE-KOTE ELECTRODES
"MANGANAL" APPLICATOR (FILLER) BAR
MANGANESE OR CARBON STEEL PARENT METAL

APPLICATOR BARS are available in ROUND, SQUARE, FLAT, SPECIAL SHAPES.

Recommended where deposition of large amounts of metal is required, such as Jaw Crushers, Mantles, R. R. Crossings, Gold Dredge Bucket Lips, Tumblers, etc.

Write for name of nearest distributor

STULZ-SICKLES CO. Sole Producers **91 N. J. Railroad Avenue, NEWARK, N. J.**

Try this NEW
JACKSON Eyeshield
on gas welding, cutting and blow torch work.

COVER-ALL TYPE—doesn't interfere with prescription glasses.

CLOSE-FITTING—fits forehead and cheeks snugly, barring light and sparks.

LIGHT—comfortable. Balanced adjustment makes it easy to push shield up out of the way.

SIDE PROTECTION afforded by large opaque fiber side pieces.

LENS RETAINER of opaque, molded Celoron. Improved spring holds lens securely and permits easy replacement.

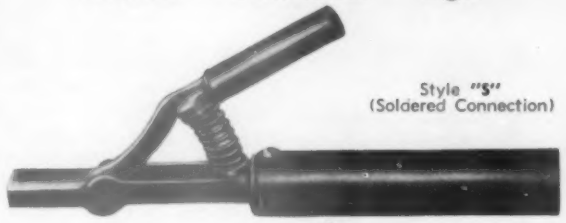
Type BX

Equipped with Federal Specification Lenses.

Write for circular, prices and name of nearest dealer.

JACKSON PRODUCTS
15122 MACK AVENUE
DETROIT, MICHIGAN

IMPROVED
SIMPLEX ELECTRODE HOLDERS
Practical — Economical — Light



Style "S"
(Soldered Connection)

Style "R"
(Removeable Connection)

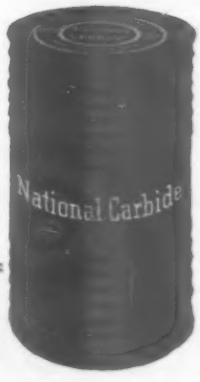
1/16" to 1/4" ELECTRODES — WEIGHT 15 OZ. EACH

Jaws of heavy copper alloy of sufficient current capacity and strength to withstand duties of its class. Sturdy compression spring supported by heat resisting insulating seats. Current can not pass through spring. Insulating fibre handle permits firm balanced grip. Style "S" (Soldered connection) has rear end of fixed jaw cored to receive cable, insulating handle covers connection. Style "R" (removeable connection) carries cable to a point ahead of handle where it is firmly clamped to prevent heating. Unnecessary to divide or rearrange cable strands.

DISTRIBUTORS IN ALL PRINCIPAL CITIES
THE FIBRE-METAL PRODUCTS CO.
CHESTER, PENNA.
WRITE FOR NEW CATALOG No. 20 JUST OFF THE PRESS

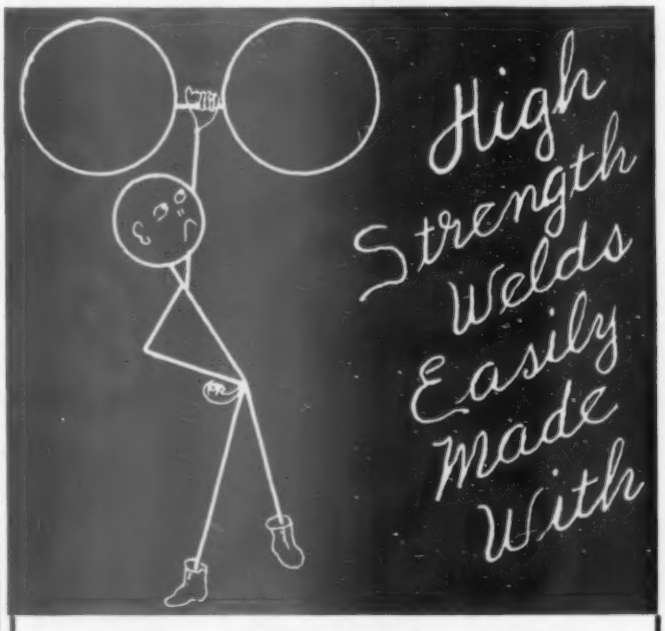
National
Carbide

EFFICIENT
ECONOMICAL
DEPENDABLE



Specify
NATIONAL CARBIDE
In The Red Drum
For
WELDING
And
CUTTING

NATIONAL CARBIDE CORPORATION
Lincoln Building — New York, N. Y.



MOLY-NICKEL RODS
An all-purpose Cast Iron Rod of close grained structure and machineable deposit.

FREE SAMPLES *upon request.*

The Chicago Hardware Foundry Co.
241 Engineering Building
NORTH CHICAGO, ILLINOIS

It is only necessary to utilize a few cycles of the current for each welding shot and, with a 60-cycle current, this affords 3600 cyles a minute which can be turned into several hundred welding shots a minute.

» «

Welding Controller

2,227,285. **Carroll Stansbury,** Wauwatosa, Wis., assigned to **Cutler-Hammer, Inc.,** Milwaukee, Wis. Filed March 26, 1938. Issued Dec. 31, 1940. There is described a welding controller which is particularly applicable to stitch welders in which it is desired to close and open a welding circuit repeatedly for timed periods and whereby both the closing and the opening periods may be independently adjusted. The system further provides for control of the moment of closure and opening of the welding circuit with respect to the time phase of the alternating current supplied to the welding electrodes.

» «

Welded Rail Bond

2,227,369. **Johann Friedrich Schneider,** Berlin, Germany. Filed Sept. 22, 1938. Issued Dec. 31, 1940. The object of this invention is the production of welded bonds and welded splice bars for railway rails and the like. A welded splice bar is produced in such a manner that the welded seams between the splice bar and the rail ends are stressed substantially by shearing strains only while tensile strains are avoided. The rail joint comprises the two aligned rail ends and a base plate extending under the feet of the rail ends and welded to the ends by a weld seam applied in the hollow between the outer edges of the rail ends and the base plate. Flat lateral splice plates are welded by longitudinal seams to the rail foot near its outer edge and to the rail stem near the head of the rail for forming a static triangle together with the rail foot and stem. Bent extensions at the ends of the splice plate are used for closing the space between the splice plate and the rail.

» «

Welder's Chipper

2,226,673. **Thomas St. Pierre,** Worcester, Mass. Filed Dec. 21, 1938. Issued Dec. 31, 1940. This tool has a handle and a chipping head attached thereto. A flanged casing attached to the handle by a clamp holds a brush whose bristles extend in a direction away from the handle. The brush may be removed and resecured in the flanged casing in a manner to relocate the bristles remote from the tool head to a position adjacent to the head.

» «

Welded Joints

2,227,193. **Karl A. Maxwell,** Versailles Township, Allegheny County, Pa., assigned to **National Tube Co.,** of New Jersey. Filed Aug. 23, 1939. Issued Dec. 31, 1940. The method of joining the ends of vertically aligned metallic sections which includes the steps of placing a flux holding member having a high coefficient of heat conductivity around one of the sections adjacent the joint, disposing a quantity of welding flux around the ends of the sections at the joint on the flux holding member, immersing the end of a welding rod in the flux adjacent the section ends, and electrically welding the section ends together by establishing an electric welding arc between the end of the welding rod and the ends of the sections. The flux melts and provides an oxidation-resistant covering for the weld metal as it is deposited at the joint. The flux holding unit is adapted to chill the molten flux thereby forcing the electric welding arc inwardly at the joint at the ends of the sections and molding the metal bead between the sections at the joint.

» «

Welding Fixture

2,227,688. **Frank J. Wood,** Riverside, Ill., assigned to **Goodman Manufacturing Co.,** Chicago, Ill. Filed Dec. 19, 1938. Issued Jan. 7, 1941. In order to obtain the best results in welding, this patent points out that it is desirable to weld in a direction so that the molten metal will flow into the joint by gravity. In doing this, especially with heavy castings or frames, it is usually necessary to lift the frame by jacks or a crane and set the frame in the desired position on blocks, and when the frame is welded on one

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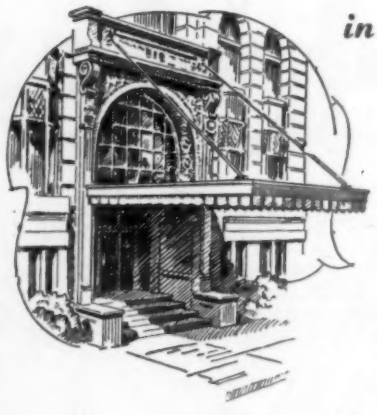

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side, it must frequently be turned over to permit welding of the other side, by the same process of jacks, or by a crane. This is a laborious and time consuming operation. The new fixture of this invention supports the frame or casting in such a manner that it may be lowered and the piece to be welded secured thereto and be elevated and rotated, or tilted about either of its ends at any desired angle, by power so that the piece may be picked up from a truck or the ground and all sides of the frame or casting may be welded in the direction of gravity without removing the piece from the fixture.

» «

Welding Control

2,227,960. **James T. Catlett,** Scotia, N. Y., assigned to **General Electric Co.,** of New York. Filed July 13, 1939. Issued Jan. 7, 1941. A control system is described for automatic arc welders. In this system the welding arc is initiated at practically the same instant that welding current and voltage is applied to the electrodes. Arc starting is facilitated by providing an automatic arc welding control in which the electrodes are rapidly fed through a very short distance into and out of engagement with one another by the electrode feeding mechanism during the period required for connecting the electrodes to a source of arc welding current and voltage. With this control it is possible to start the traversing movement between the welding arc and the work at about the same time that the welding contactor closes to supply welding current and voltage to the electrodes.

» «

Welding Compound

2,228,369. **Wilbur B. Miller,** Niagara Falls, N. Y., assigned to **The Linde Air Products Co.,** of Ohio. Filed Feb. 10, 1940. Issued Jan. 14, 1941. For welding thin sheets, e. g. 8 to 16 gage steel sheet, or for welding chromium and chromium-nickel steels and austenitic chromium-nickel steel sheets and plates a composition is described which is made up of 34% to 42% silica, 28% to 10% alumina and the remainder lime and magnesia. From 2% to 25% of a melting-point depressant, such as an alkaline earth metal halide or manganese oxide, may be added. The composition may be used for welding other metals than the thin sheets mentioned above.

» «

Welding Device

2,228,867. **Walter Borstel,** Dessau-Siedlung, Germany, assigned to **Junkers,** Dessau, Germany. Filed July 21, 1938. Issued Jan. 14, 1941. The patent deals with a welding machine having guiding devices for moving the workpieces along any configuration, either straight or curved. Guide rollers are connected with one of the electrodes, the rollers being aranged along a line determined by the welding points.

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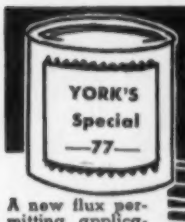

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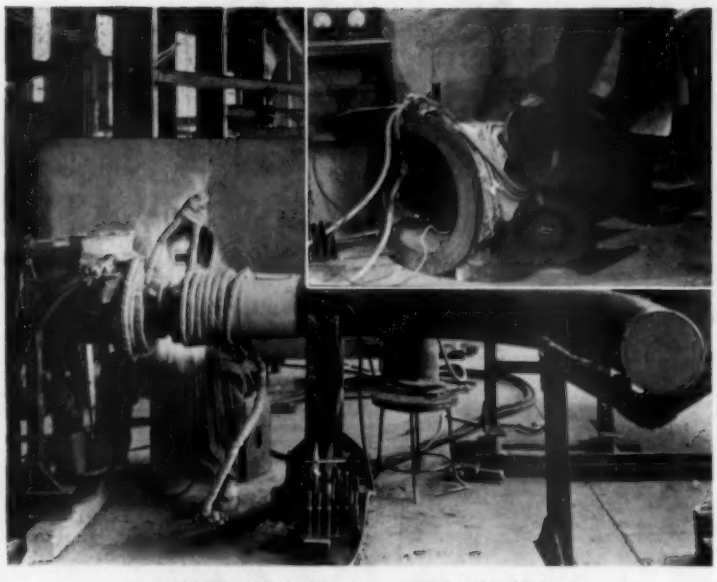

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